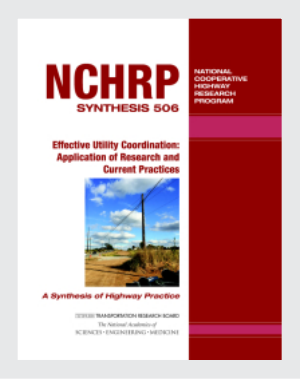

Effective Utility Coordination: Application of Research and Current Practices

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NCHRP
SYNTHESIS 506

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Effective Utility Coordination: Application of Research and Current Practices

A Synthesis of Highway Practice

TRB TRANSPORTATION RESEARCH BOARD
The National Academies of
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2017

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

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The Transportation Research Board of the National Research Council was requested by the Association to administer the research program because of the Board's recognized objectivity and understanding of modern research practices. The Board is uniquely suited for this purpose as it maintains an extensive committee structure from which authorities on any highway transportation subject may be drawn; it possesses avenues of communication and cooperation with federal, state, and local governmental agencies, universities, and industry; its relationship to the National Research Council is an insurance of objectivity; it maintains a full-time research correlation staff of specialists in highway transportation matters to bring the findings of research directly to those who are in a position to use them.

The program is developed on the basis of research needs identified by chief administrators of the highway and transportation departments and by committees of AASHTO. Each year, specific areas of research needs to be included in the program are proposed to the National Research Council and the Board by the American Association of State Highway and Transportation Officials. Research projects to fulfill these needs are defined by the Board, and qualified research agencies are selected from those that have submitted proposals. Administration and surveillance of research contracts are the responsibilities of the National Research Council and the Transportation Research Board.

The needs for highway research are many, and the National Cooperative Highway Research Program can make significant contributions to the solution of highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement rather than to substitute for or duplicate other highway research programs.

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Cover figure: A delayed highway construction project due to a yet-to-be-relocated utility pole. *Credit*: Roy Sturgill, Kentucky Transportation Cabinet.

FOREWORD

Highway administrators, engineers, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and unevaluated. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem.

There is information on nearly every subject of concern to highway administrators and engineers. Much of it derives from research or from the work of practitioners faced with problems in their day-to-day work. To provide a systematic means for assembling and evaluating such useful information and to make it available to the entire highway community, the American Association of State Highway and Transportation Officials—through the mechanism of the National Cooperative Highway Research Program—authorized the Transportation Research Board to undertake a continuing study. This study, NCHRP Project 20-5, "Synthesis of Information Related to Highway Problems," searches out and synthesizes useful knowledge from all available sources and prepares concise, documented reports on specific topics. Reports from this endeavor constitute an NCHRP report series, *Synthesis of Highway Practice*.

This synthesis series reports on current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals. Each report in the series provides a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems.

PREFACE

Tanya M. Zwahlen
Consultant
Transportation
Research Board

This Synthesis documents the state of the practice regarding utility coordination. The objective of the project was to determine how previous research has been incorporated into current practice and compile information about how transportation agencies and utility stakeholders are scoping, conducting, and managing effective utility coordination. The report documents the core elements of effective utility coordination, as reported by state transportation agencies (STAs); current practices to manage consultant-led utility coordination, both stand-alone and those incorporated into design contracts; and current practices to perform utility coordination in-house.

The study was developed with a literature review, a survey of STAs, and interviews. The literature review is a concise list of resources related to utility coordination processes. The survey sought to establish the state of the practice regarding utility coordination, determine related research being implemented, and ascertain effective utility coordination practices. The follow-up interviews with representatives from six states—Kentucky, Maryland, Utah, Virginia, Washington, and Wyoming—occurred during the final stages of the survey questionnaires.

Roy E. Sturgill, Timothy R.B. Taylor, and Ying Li, University of Kentucky, Lexington, collected and synthesized the information and wrote the report. The members of the topic panel are acknowledged on the preceding page. This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As progress in research and practice continues, new knowledge will be added to that now at hand.

CONTENTS

Note: Many of the photographs, figures, and tables in this report have been converted from color to grayscale for printing. The electronic version of the report (posted on the web at www.trb.org) retains the color versions.

EFFECTIVE UTILITY COORDINATION: APPLICATION OF RESEARCH AND CURRENT PRACTICES

SUMMARY

"Effective [utility] coordination during construction begins with better coordination prior to construction" (Thorne et al. 1993).

This quote from FHWA's *Highway/Utility Guide* presents a fundamental practice for utility coordination: early involvement, communication, and planning are essential. The objectives of this synthesis were to capture the state of the practice regarding utility coordination, its effectiveness, and how recent utility coordination research has been implemented. State transportation agencies (STAs) will be able to review this work to gain perspective on the state of the practice in utility coordination, gain insight on what others may consider effective utility coordination, and find a path forward for research and practice to advance to the state of the art regarding utility coordination.

The central method for conducting this synthesis was a survey of STAs. The questions sought to establish the state of the practice regarding utility coordination, determine related research being implemented, and determine effective utility coordination practices. The survey was sent to the AASHTO Subcommittee on Right-of-Way, Utilities, and Outdoor Advertising Control and garnered a response rate of 84% (42 states out of the 50 surveyed). In addition to the STA survey, a non-STA utilities stakeholder survey was developed and sent to several organizations including the National Utility Locating Contractors Association, the American Society of Civil Engineers Utility Engineering and Surveying Institute (ASCE-UESI), members of the Transportation Research Board Standing Committee on Utilities, research panel contacts, and others. The non-STA survey received 29 responses. Utility owners accounted for 16 of those responses.

In support of the survey development and compilation of this report, a literature review was conducted on areas related to utility coordination. Much of this review centered on location practices and the Strategic Highway Research Program 2 (SHRP 2) utility products, but it also included selected training, education, and academic literature as well as published procedures and policies related to effective utility coordination at STAs. The compilation of these resources as found in chapter two presents STAs with a concise list of resources for further investigation when considering improvements to their utility coordination processes.

The surveys and literature review were further used to identify STAs of interest for follow-up interviews. This work occurred during the final stages of the survey questionnaires. Representatives from six states—Kentucky, Maryland, Utah, Virginia, Washington, and Wyoming—were interviewed face-to-face while attending the annual meeting of the AASHTO Subcommittee on Right-of-Way, Utilities, and Outdoor Advertising Control. The interviewees were selected not only to achieve a diverse regional sampling but to question those at various implementation stages of recent utility coordination research and practices. The goal of the interviews was to provide depth and richness to the information

gathered from the survey. The interviews may serve as case examples to other STAs that are developing or enhancing their utility coordination procedures.

Several notable conclusions were reached through combined assessment of the literature, survey responses, and case examples. These are summarized along the following topics:

- *Utility Coordination Scoping*—The survey analysis produced a prioritized list of factors for how STAs set the scope of utility coordination involvement for a project; that is, what project characteristics lead to increased utility coordination involvement. Ninety percent of STA respondents reported that they have a documented process for determining the utility coordination scope of a project. These results are valuable to the STAs that review this information and could be used to assess risk and assign constrained resources (personnel, consultants, etc.).
- *Organizational Structure Variation*—Survey results indicate that utility personnel are housed at various locations organizationally across STAs. Additionally, STAs operate differently at the local/regional/district level than at the statewide/central office level. This variance can cause confusion with utility stakeholders both within and outside the STA and can add complexity to recommendations. This issue is outlined in the SHRP 2 R15B Final Report. The report states that it is important for the STA and utility owner to understand one another's business processes. It is promising to note, however, that 86% of respondents stated that the utility coordination for a specific project uses a single point of contact at the STA.
- *Utility Coordination as Part of the Design Process*—The case example interviews and literature reviewed suggest better incorporation of utility coordination into the transportation design process and early involvement of utility coordinators and owners. With complex facilities and the many nuances of regulations, utility coordination warrants emphasis at the environmental process level. The survey results indicated that, in some cases, designers and design managers are not involved in the utility coordination process from the start. In addition, right-of-way agents appeared involved much later in the utility coordination process. If right-of-way agents are not aware of utility needs, severe complications and delays can occur. Research suggests that utility stakeholders should be involved early in the design process, and project stakeholders should be well informed throughout the utility coordination process.
- *Consultant-Led Utility Coordination*—Consultant-led utility coordination often occurs out of necessity (due to lack of personnel availability or experience), but to be effective it must be used with careful controls in place such as certification, prequalification, and evaluation. Responses regarding consultant-led utility coordination indicated that 57% of the respondents require the consultant to be prequalified to manage utility coordination and 67% of the respondents evaluate their consultants on their utility coordination efforts. Also, designer consultant-led utility coordination and stand-alone consultant-led utility coordination resulted in different levels of satisfaction among the survey respondents. According to case example interviews, stand-alone consultant-led utility coordination achieved a higher rate of satisfaction because this process uses specialized consultants who have more utility coordination experience. The case example interviews illustrated that significant disconnects often occur in transportation design professionals' understanding of the utility coordination process and requirements of the process. Survey results indicated that consultant-led utility coordination is better managed by consultants selected specifically for that purpose. The consultant expertise required to conduct utility coordination services as part of the design constant contract may be lacking. Last, one of the most important aspects of using consultant-led utility coordination is why STAs choose it: limited in-house staff. Sixty-seven percent of respondents used consultant-led utility coordination for this reason.
- *Effective Utility Coordination Practices*—One goal of this study was to provide a definition of what was considered effective utility coordination. When asked whether

there was a measure within their STA to gauge utility coordination effectiveness, 52% responded they "Do Not Measure Utility Coordination Effectiveness." Through follow-up discussion of the case examples, some STAs revealed the use of anecdotal measures, while others have defined schedule and budget performance measures. This response does present a possible need for more formalized measures of utility coordination effectiveness. Through the survey results, this synthesis highlights several practices for effective utility coordination, including better communication, timely involvement, and making utility alignment more integral to the design process. Additional effective practices are noted in the report, with the top practices as determined from the survey results noted in Table 1 as presented by the various respondent groups.

TABLE 1
STA EFFECTIVE UTILITY COORDINATION PRACTICES

Element	Percent of STA Respondents Selected (n = 42)	Number of Non-STA Respondents Selected (n = 29)	Number of Utility Owners Selected (n = 16)
Early Utility Involvement in Design (30% or earlier)	88% ✦	26 ✦	15 ✦
Utility Preconstruction Meetings	67% ☆	20 ✦	12 ✦
Defined Procedures (i.e., Utility Coordination Guidance Manual)	67% ✦	17 ✦	8 ☆
Consideration of Utilities Relocation Schedules in Relation to Project Schedules	74% ✦	15 ☆	10 ✦
Use of SUE (Subsurface Utility Engineering)	57% ☆	13 ☆	2
Regularly Scheduled Meetings with Utility Owners	57% ☆	12 ☆	5
Communication of Short-Range Transportation Plan	21%	12 ☆	9 ☆
Use of Utility Corridors	14%	12 ☆	8 ☆
Use of Standardized Utility Agreements	60% ☆	8	6
Identification of and Plan for Long-Lead Items	50% ☆	4	0
Utility Mapping System (utility location information entered into a GIS-based system)	26%	10	7 ☆
Communication of Long-Range Transportation Plan	24%	10	7 ☆

✦ Top three elements selected by respondents.
☆ Top eight elements selected by respondents.
Respondents were limited to choosing their top eight.

- *Utility Owner and STA Perceptions*—Beyond showing what practices are considered effective, Table 1 also illustrates potential areas to be addressed concerning the perception of STAs and utility owners. For instance, early utility involvement in design is unanimously the preferred practice, as is utility preconstruction meetings, consideration of utility and project schedules, and defined procedures. Of note, there is a substantial disagreement about the effectiveness of subsurface utility engineering (SUE) between the STAs and utility owners. Also, utility owners would prefer that utility corridors be used more and long-range transportation plans be shared.
- *Legislation, Regulations, and Guidance*—The flexibility in federal legislation, regulations, and guidance, while beneficial to STAs adopting policies to meet their specific needs, creates inconsistencies in utility coordination for utility companies working

in multiple states. With many utility facilities moving toward national conglomerates, this practice may need to be revisited.

- *A Framework or Guidance for Effective Utility Coordination and Applied Research*—Structure and guidance in utility coordination are needed to increase consistency in regulations and application of practice from state to state. The goal is not to achieve complete standardization but to build consistency for utility owners working across state boundaries and to achieve utility coordination objectives. One potential area for improvement is increasing proactivity in utility coordination. In ranking terms to describe their utility coordination process (reactive, interactive, or proactive), STAs responded nearly equally to interactive and proactive. If the term "proactive" becomes a more prevalent descriptor of utility coordination processes, improvements are likely. In addition, utility coordination would benefit from a strategic approach to the application of research, such as the prioritized application of the SHRP 2 products. Research attempting to improve various aspects of utility coordination independently has led to a lack of consensus over how to integrate these research efforts into an effective standard of practice. Some results of this synthesis indicate that the lack of a standard for new research and technologies may need to be resolved before benefits from such research can be realized.
- *Training and Education*—The lack of education and training opportunities for utility personnel and coordination is significant. The National Highway Institute (NHI) and ASCE-UESI have attempted to fill this void. However, because accommodation policies and legislation vary from state to state, STAs may benefit from offering state-specific training to clientele outside of the STA. With personnel and knowledge loss, and increased use of consultant-led utility coordination or utility coordination as part of an alternatively delivered project, knowledge management within utility coordination is at a critical juncture. Only 20% of the responding STAs offer or require training or certification in utility coordination, and most are predominantly offering training to in-house staff only. With growing complexity in utility facilities and utility management and coordination, the lack of trade and higher education offerings that cover utility topics is concerning.
- *Research Needs*—In addition to understanding the use of SUE and advanced utility location technologies, there is a need for standards of practice, guidance, and training for utility coordination. STAs, consultants, and utility owners may benefit from a knowledge management approach such as a guidebook.

In conclusion, the research team and panel designed a study that integrated multiple resources of value about effective utility coordination practices. The sources and references within the literature review illustrated many avenues for future investigation. The survey results revealed the state of the practice and the steps that some STAs are taking to improve their utility coordination practices. The case examples outlined some of the approaches used by several of the nation's respected utility coordination professionals.

CHAPTER ONE

INTRODUCTION

BACKGROUND

Utility and transportation facilities often share real estate (utilities within transportation right-of-way) in order to provide services to the public by the most economical means. This long-held sentiment is relayed in FHWA report *Highway/Utility Guide* (1993) and in other references (Thorne et al. 1993; Anspach 2010). For these benefits to manifest themselves without detriment to utility or transportation projects, effective utility coordination is essential. The purpose of this synthesis is to canvas state transportation agencies (STAs) to establish the state of the practice for effective utility coordination.

Owing to a lack of terminology and process standardization across and within STAs, "utility coordination" has become a very broad and ambiguous term. Additionally, "effective utility coordination" may be an even more difficult term to define. STAs may handle utility coordination processes differently and within different business units. These variances are within the allowances of federal regulations (23 CFR 645 and specifically Subpart B, Subsection 645.211). For example, as described in the *Program Guide: Utility Relocation & Accommodation on Federal-Aid Highway Projects,* the definition for "utility" as it pertains to reimbursement for relocation is broad in scope and relies on the individual state law to determine if the law treats the facility as a utility (2003). Hence, because state laws will vary, the definition of a utility will vary. For example, cable television is viewed by some states as a utility but to other states it is not. To assist with the terminology used in this report, a glossary is provided. However, one key definition presented here is "utility coordination." For the purposes of this report, utility coordination is the active effort to communicate, share information, and interact productively with all applicable stakeholders about utility involvement, adjustment, and relocation during all phases (planning, design, construction, operation, and maintenance) of the delivery of a transportation project (Thorne et al. 1993).

The commonly accepted focus areas of utility coordination include the following:

- Providing communication, identification, and engineering expertise throughout utility and transportation project interaction;
- Minimizing both utility and transportation project impacts;
- Determining relocations and initiating them; and
- Reimbursing relocations and disturbances as applicable, according to complex and nonstandard (varying from state to state) regulations.

Effective utility coordination can improve the delivery of transportation and other capital facility projects and reduce project risks posed by delays, safety hazards, and cost overruns. Utility coordination entails agreements, estimates, risk identification and management, reimbursements, and all other terms associated with these interactions. Utility coordination is effective when there are minimalized impacts to the transportation project and utility facilities.

Recent research has attempted to enhance utility location technology and procedures, instill a framework that may include tools for utility coordination, and develop systems for risk management relative to utility coordination. However, simultaneous implementation of research attempting to improve various aspects of utility coordination has led to a lack of consensus about how to integrate these research efforts into an effective standard of practice.

PROJECT SCOPE, GOALS, AND OBJECTIVES

The scope of this research synthesis is confined to the analysis of information collected from survey respondents, literature, and case-based interviews. With this in mind, the research team, with guidance from the research panel, developed questionnaires with the goal of collecting the following types information relative to effective utility coordination:

- Identification of the core elements of effective utility coordination;
- Current practices in managing consultant-led utility coordination, both stand-alone and those incorporated into design contracts;
- Current practices in performing utility coordination in-house;
- How and when stakeholders are integrated into the utility coordination process (e.g., design team, contractors, utility owners, consultants, and resource agencies);
- Prequalification requirements for consultants and evaluation measures of performance;
- Training and certification available and/or required for utility stakeholders;
- How academic programs are educating students about utility engineering;
- The process by which an effective utility coordination project is scoped (e.g., project schedule, type and complexity of project, level of effort, and level of risk);
- Gaps in knowledge and research; and
- Examples of inconsistencies between legislation, regulations, guidance, and practice.

The objective of the synthesis is to document how previous research has been incorporated into current utility coordination practice, how STAs and utility stakeholders are scoping, conducting, and managing utility coordination, and what coordination practices are considered effective. This synthesis focuses on the successful application of technologies and research recommendations, identification of educational resources, and procedures by which effective utility coordination practices are incorporated into project utility coordination. Additionally, this effort investigates the interaction and feedback among utility stakeholders outside the STA including consultants, utility owners, researchers, and contractors from a second survey issued to non-STA stakeholders.

This synthesis highlights the state of the practice so that efforts can be made to fill research gaps and establish a path to improvement. Some issues facing effective utility coordination for STAs include a lack of staffing resources, standard terminology, and application of research, technology, and coordination practices in general.

RESEARCH METHODOLOGY

The central aspect of the research methodology is the survey of STAs to establish a state of the practice regarding utility coordination, determine related research being implemented, and determine practices viewed as effective in utility coordination. The survey was sent to the AASHTO Subcommittee on Right-of-Way, Utilities, and Outdoor Advertising Control and garnered a response rate of 84% (42 of the 50 states surveyed). In addition to the STA survey, a non-STA utilities stakeholder survey was developed and sent to several organizations including the National Utility Locating Contractors Association (NULCA), the American Society of Civil Engineers Utility Engineering and Surveying Institute (ASCE-UESI), members of the Transportation Research Board Standing Committee on Utilities, research panel contacts, and others.

In support of survey development and compilation of this report, a literature review was conducted on topics related to utility coordination. Much of this review centered on location practices and the Strategic Highway Research Program (SHRP 2) utility-related products, but it also included a review of select training, education, and academic literature as well as published procedures and policies related to effective utility coordination at STAs.

With regard to the surveys, the full questionnaires can be found in the appendices. The survey attempted to gather information regarding the following:

- Procedures and effectiveness of utility coordination processes
- Organizational structure relative to utility coordination processes
- Elements of effective utility coordination
- Timeliness of utility coordination
- Incorporation of SHRP 2 utility products
- Use and evaluation of consultant-led utility coordination
- Guidance and legislation inconsistencies
- Research and knowledge gaps.

The non-STA stakeholder survey was similar in scope to the STA survey but eliminated lines of questioning that applied only to STAs, such as inquiries about STA structure. The non-STA survey attempted to collect information regarding stakeholders' experiences with effective utility coordination so these experiences could be compared with STA feedback.

Concurrent with the final stages of the survey questionnaires, STAs were identified for follow-up interviews via literature review and initial survey responses. Representatives from six states— Kentucky, Maryland, Utah, Virginia, Washington, and Wyoming—were interviewed face-to-face while attending the annual meeting of the AASHTO Subcommittee on Right-of-Way, Utilities, and Outdoor Advertising Control. The interviewees were selected not only to achieve a diverse regional sampling but to question those at various implementation stages of recent utility coordination research and practices. The goal of the interviews was to provide depth and richness to the information gathered from the survey. Specific details collected included the following:

- Use and application of utility coordination methodology;
- Decisions on whether to use in-house or consultant-led utility coordination;
- Recent applications of research, plans, or processes for applying technologies or coordination efforts; and
- Overall coordination procedures.

The interviews serve as case examples to other STAs for developing or enhancing their utility coordination procedures.

REPORT STRUCTURE

This report synthesizes the findings about the state of the practice of utility coordination and its effective implementation. The authors' charge in this report is strictly to present information as collected void of opinion and bias. The opinions expressed in the presentation from detailed case examples are those of the utility professionals and should be viewed as such. The report is organized as follows:

- Literature Review
- Survey Results
- Case Examples
- Conclusions.

CHAPTER TWO

LITERATURE REVIEW

The literature review provided background for the development of the survey tools, case interview questions, and synthesis of the data for this report. This chapter presents summaries of many of the resources reviewed. The chapter also presents a collection of current practices within utility coordination procedures at STAs as identified from the literature reviewed. STAs may find these resources useful when considering improvements to their utility coordination procedures or when adopting new practices. This information also serves as background for the survey results described in chapter three and the case examples described in chapter four.

BACKGROUND LITERATURE

Several dated reports are still relevant and contribute valuable information about utility coordination and relocation practices. The 1993 FHWA *Highway/Utility Guide* provides a thorough history of utility accommodation along highways and, for its time, was the single informational source for utilities and highways sharing common right-of-way (Thorne et al. 1993). This report highlighted concepts of early involvement, location practices, and accommodation practices. AASHTO's *A Guide for Accommodating Utilities Within Highway Right-of-Way* also influenced this report and associated survey tools (2005). This resource, along with AASHTO's *A Policy on the Accommodation of Utilities Within Freeway Right-of-Way* (2005), guided the survey and case questions and helped develop the definition of terms in the glossary. These resources collectively presented the importance of utility accommodation in highway right-of-way and highlighted the need for utility coordination practices.

STATE TRANSPORTATION AGENCY UTILITY COORDINATION PRACTICES

The next area of literature review involved an investigation of utility coordination practices used by STAs. Sturgill et al. (2014) previously synthesized a list of utility coordination practices that was used to develop survey questions about the types of practices implemented and the perception of their effectiveness by STAs. This resource was complemented by the AASHTO Standing Committee on Highways' Strategic Plan Strategy 4-4 (Right-of-Way and Utilities Guidelines and Best Practices, Standing Committee on Highways 2004) for the purpose of question development (2004). In reviewing these resources, a list of utility coordination best practices was developed. These resources also provided some insight on where in the project timeline STAs plan utility coordination practices. This, along with information summarized in Table 2 adapted from SHRP 2 Report S2-R15-RW, was used in the development of the survey questionnaire (Ellis et al. 2009). Table 2 is provided here to illustrate several of the utility coordination practices used by a subset of STAs.

These resources influenced the line of questioning for survey respondents about their use of "best practices" as found in multiple widely accepted guidance documents. Inquiries were also made about when their utility coordination practices take place in relation to their design process. In regard to timing, previous research, as shown in Table 2, indicates many STAs regard 30% design plans (preliminary design) as the appropriate time for involvement of utility coordination. However, after review of a typical STA project development process seen in Figure 1, waiting until preliminary design to initiate utility coordination efforts could be problematic depending on the level of environmental agreements already completed for the project and right-of-way requirements. If, for example, alignment alternatives are set according to environmental agreements but those alignments are later found to have substantial utility impacts, a project manager may be faced with difficult and costly decisions that may have been eliminated with earlier utility involvement. Current research (such as Sturgill et al. 2014) supports much earlier utility involvement in the project development process. Of note, Figure 2 illustrates that 49% of this study's survey respondents are abiding by current research trends and beginning utility coordination earlier than the 30% design plans.

TABLE 2
SUMMARIZED USE OF UTILITY COORDINATION PROCESSES

Process	Sub-Process	AZ	CA	CO	FL	IN	KY	MI	NY	PA	TX	VA
Long-Range Plan and Communication with Utility Owners				☐	☐		☐	☐	☐	☐	☐	☐
Utility Coordinating Committee				☐	☐		☐				☐	☐
Utilize Joint-Use Agreements			☐	☐							☐	
Training Program for Project Design Engineers on Utility Relocations			☐	☐						☐	☐	☐
Statewide Utility Mapping System							☐			☐	☐	☐
Identify Utilities in Conflict (percent design stage)	30%, 60%, or 90% design stage	30		30	30	30		60	30	30	30	30
Location Information from Utilities (percent design stage)	30%, 60%, or 90% design stage	30		30	30	30		30	30	30	30	30
Utilities Begin Relocation Design (percent design stage)	30%, 60%, or 90% design stage	60	30	60	60	60		90	60	60	60	60
Use of One Call System				☐	☐	☐			☐	☐		
Conduct Field Survey			☐			☐	☐		☐	☐	☐	☐
Use of SUE				☐	☐	☐	☐		☐	☐	☐	☐
Utility Coordination Meeting		☐	☐		☐	☐	☐	☐		☐	☐	☐
Provide Utility Owners Contact List		☐				☐	☐	☐		☐	☐	☐
Outsource Relocation Design	Utility owners can use design consultants	☐	☐	☐			☐	☐		☐		
	DOT can act as utility owners' design consultant		☐	☐			☐	☐		☐		
Preconstruction Meeting		☐	☐	☐	☐	☐	☐	☐		☐	☐	☐
Utility Preconstruction Meeting										☐		
Partnering Meetings								☐		☐	☐	☐
Relocation Work Performed Before Construction, When Feasible			☐	☐		☐		☐	☐	☐		
Relocation Work	Utility owner performs relocation	☐	☐	☐		☐		☐	☐	☐	☐	☐
	Use of subcontractors	☐	☐	☐		☐		☐	☐	☐	☐	☐
	Use of DOT's contractors	☐	☐	☐		☐		☐	☐	☐	☐	☐
Field Conflict Resolution Process			☐									
Post-Construction Meeting							☐					
Process for Unexpected Utility Conflicts During Construction			☐	☐			☐					
As-Built Requirements	Provided by utility owners											
Design–Build Contracts												

RECENT RESEARCH

The most discussed research involving utility coordination is the SHRP 2 products. These products assist STAs with state-of-the-art methods of location, data management, and utility conflict resolution. Much of this research seeks to standardize location technology and associated data, although R15B ties in keenly with utility coordination during the management of

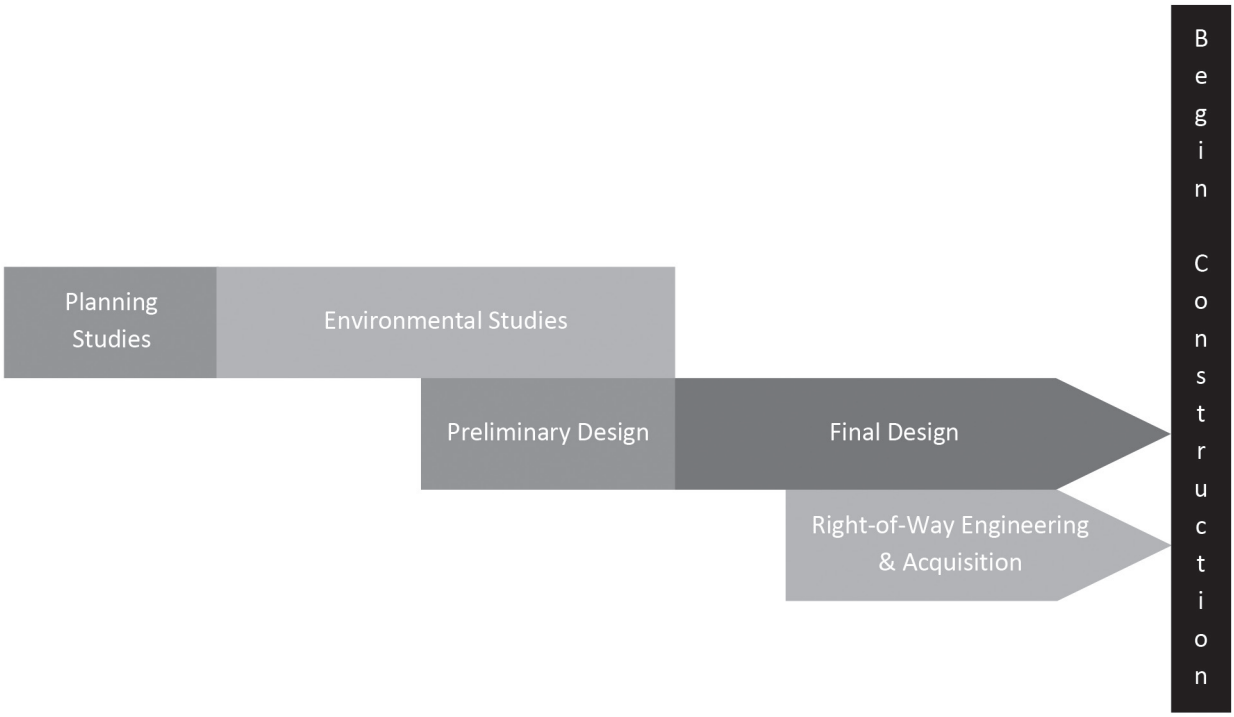

FIGURE 1 A typical STA project development process.

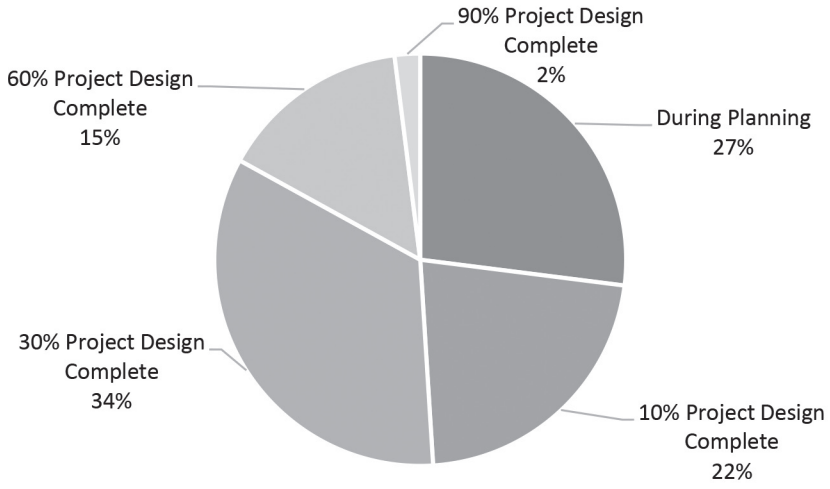

FIGURE 2 STA survey responses for timing of utility involvement.

utility conflicts and risk. Several pilot programs are in place. These topics are incorporated into the survey and interviews, and as evidenced from the case example interviews, adoption of these practices into formalized utility coordination procedures can improve STA utility coordination programs. The SHRP 2 products include the following:

- 3D Utility Location Data Repository (R01A)

https://www.fhwa.dot.gov/goSHRP2/Solutions/All/R01A/3D_Utility_Location_Data_Repository

The SHRP 2 R01A product provides a three-dimensional (3D) data storage and retrieval model that can influence utility coordination by making location information readily available. According to the SHRP 2 website (emphasis added), "The data stored will include the horizontal and vertical location of the utilities, as well as attribute data that is needed to *effectively coordinate* with utility owners."

- Utility Investigation Technologies (R01B)

https://www.fhwa.dot.gov/goSHRP2/Solutions/Renewal/R01B/Utility_Investigation_Technologies

The SHRP 2 R01B product presents a collection of credible nondestructive geophysical location technologies. This information—when used within a SUE process—can present engineers with the best collection of multisensor tools for detecting and locating utilities when varying geophysical characteristics are present. R01B focuses specifically on the use of two technologies: time-domain electromagnetic induction and multichannel ground-penetrating radar. These types of advanced technologies were queried for their use and effectiveness within the survey.

- Innovation in Location of Deep Utilities (R01C) (Hammerschmidt et al. 2015)

Early in the SHRP 2 R01C project, the research team determined the project would be more effective if focus was placed on shallower yet more difficult to locate utility facilities, such as stacked utilities. Therefore, R01C became closely integrated with the R01B project but avoided duplication. The R01C project focused on such location technologies as long-range radio frequency identification tagging and active acoustic location by placing acoustic generators on the facility/pipe.

- Identifying and Managing Utility Conflicts (R15B)

https://www.fhwa.dot.gov/goSHRP2/Solutions/Renewal/R15B/Identifying_and_Managing_Utility_Conflicts

SHRP 2 R15B is directly related to this synthesis, where the previously mentioned product may be somewhat auxiliary to utility coordination. The early phases of this product present the Utility Conflict Matrix as a tool to identify, track, and manage utility-related conflicts during project development. This framework presented STAs with a tool to conduct utility coordination in a more strategic and systematic approach. The final report of this product, however, goes on to highlight many of the same findings that were mentioned in the survey and case example feedback herein. For example, the report notes that because STAs do not include utility relocation/coordination as being integral to the design process, utility owners become involved after much of the design is already completed, potentially causing delays and rework that could be avoided by earlier involvement. Some notable conclusions from this report include the following:

- Utilities owners have limited resources.
- Utility relocation/coordination is not the primary focus of transportation designers.
- Coordination of multiple utility owners is often problematic.
- STAs operate on short time frames to deliver projects.
- Delayed coordination with utility owners often results in right-of-way issues (if utility right-of-way needs are not considered).
- One-call locator information may not be as timely or as accurate as needed.
- Utility owners and transportation construction contractors may incur schedule delays because they do not synchronize operations.

As a recommendation, the report presents the following initiatives:

- Operate as a team.
- View utilities in highway right-of-way as the STA's responsibility.
- Understand/learn the business processes for the counterpart (utility owner/STA).
- Improve location and mapping methods (Ellis et al. 2009).

Also note, case examples are available for R15B for the Kentucky and Michigan pilot uses of Utility Conflict Matrices:

Kentucky: https://www.fhwa.dot.gov/goSHRP2/Content/Documents/SHRP2_R15B_KYTC.pdf

Michigan: http://SHRP2.transportation.org/documents/home/MichiganDOTR15BCaseStudyFINAL.pdf

More information may be found on all of these products within their associated reports in the references section of this synthesis.

TRAINING, EDUCATION, AND THE WORKFORCE

Constrained resources was an issue that the SHRP 2 products presented as a potential cause for utility relocation delay. STAs are all too familiar with resource constraints—70% of the surveyed STAs that use consultant-led utility coordination do so based on a lack of personnel or expertise. Additionally, a recent synthesis study by Taylor and Maloney presented declining staff as an STA concern in general. Eighty-six percent of their survey respondents reported they were doing more work with fewer employees. On average, the responding states had 4% more lane miles in their system, with capital spending increased by over 50% when taking inflation into account, and full-time employee numbers were down 9.68% (Taylor and Maloney 2013).

Another concern related to personnel in utility coordination is the small number of opportunities for training and education. All the survey respondents noted they were unaware of any formal education (university or technical programs) opportunities related to utility coordination. One notable source of training is a free, 4-hour, web-based introductory course on utility coordination for highway projects that is offered by NHI and serves as a prerequisite for its 2-day instructor-led course (courses FHWA-NHI-134006 and FHWA-NHI-134006A). The topics covered include the following:

- Regulatory requirements for public and private utilities,
- Importance of communication and cooperation during coordination,
- Use of SUE, and
- States' accommodation policies.

More information for the course can be found at:

http://www.nhi.fhwa.dot.gov/training/course_search.aspx?course_no=134006&sf=1.

In addition, some STAs have developed their own utility coordination training (such as Indiana, Florida, Georgia, and Texas). Indiana Department of Transportation (INDOT) (other STAs have similar programs) has gone so far as to make the utility coordination training a prequalification for any consultants who conduct consultant-led utility coordination. INDOT's training and certification program is a 2-day course with an exam that requires a passing score of 75%. Additionally, to take the certification training, an individual must hold a Bachelor of Science in Engineering and 2 years of highway or utilities experience, or 4 years of highway or utilities experience with at least 1 year of experience in utility coordination. This program began in 2014 and more information can be found at:

http://www.in.gov/indot/3268.htm.

Another source of information and potential training is the recently initiated Utility Engineering and Surveying Institute as part of ASCE. ASCE-UESI was formed by combining several utility- and surveying-related divisions with like central causes. The goal of the institute is to promote excellence in and be a central source of information related to the engineering, planning, design, construction, operations, and asset management for utility infrastructure and engineering surveying. More information can be found at:

http://www.asce.org/utility-engineering-and-surveying/utility-engineering-and-surveying-institute/.

ASCE-UESI has already begun to collaborate on developing materials and training for building knowledge in the utilities and surveying fields. In collaboration with the Louisiana Tech University's Trenchless Technology Center, ASCE-UESI created the 2016 Utility Investigations School. This intensive course will provide students the knowledge and tools for competent utility investigations in accordance with accepted national standards. The course is a 1-week graduate-level course. More information can be found at:

http://www.ttcspecialtyschools.com/uis/.

ADDITIONAL RESOURCES

Several resources related to utility coordination, in addition to the ones previously mentioned, are discussed below. Notably, FHWA provides a good repository website for several sources of information (http://www.fhwa.dot.gov/utilities/). This website presents training opportunities, online webinars, and resource materials related to highway utility coordination. Additional resources for reference include the following:

- E-construction
  - E-construction is a relatively recent advancement in construction management for STAs. FHWA has been a proponent of its expanded use as part of FHWA's Every Day Counts initiative. While there are multiple facets to e-construction, one most pertinent to utility location and information is the use of 3D plans, the development of 3D as-built plans, and the electronic capture of project information for future use. By tying utility location information into the 3D as-built drawings and associating a quality level to these locates as part of SUE, a bond between utilities and construction is formed as is a feedback loop for providing future design projects with accurate and thorough utility location information. More information can be found at:

    https://www.fhwa.dot.gov/construction/econstruction/ and
    https://www.fhwa.dot.gov/innovation/everydaycounts/edc-3/econstruction.cfm.

- *NCHRP Report 821: Effective Project Scoping Practices to Improve On-Time and On-Budget Delivery of Highway Projects* (Anderson et al. 2016)
  - This recently published report highlights the importance of utility impact assessments and of establishing an inventory of project-affected utilities for delivering projects on time and on budget. The report notes that these are items to be assessed during the project scoping stages. One level of the utilities assessment is to gather information from utility owners as well as one-call services. This illustrates the need to involve the utility owners much earlier than the 30% design phase historically presented as the proper point for utility owner involvement. Again, this dovetails into the survey results presented in synthesis findings herein that 49% of the respondents involve utilities prior to that point.

- FHWA Report (FHWA-HRT-16-019), *Feasibility of Mapping and Marking Underground Utilities by State Highway Agencies* (Quiroga et al. 2016)
  - This recent study takes a step beyond the SHRP 2 R01 products to conduct a detailed investigation of the feasibility and practical application of STAs capturing and warehousing the location data of utilities within their right-of-way. Additionally, the study presents return on investment for the availability of information such as the knowledge of the accuracy of this information. The report presents the perceived and actual challenges to implementing such an approach and provides a framework for doing so. The report presents what some STAs are trying in order to achieve better accuracy in the location information of the utilities in their right-of-way, such as the using radio-frequency identification devices (marker balls).

- *NCHRP Synthesis 405: Utility Location and Highway Design* (Anspach 2010)
  - This synthesis presents the fundamental challenge associated with utility coordination and highway design. It discusses STA procedures for involving, locating, and resolving conflicts about utilities based on the types and severity of the utility impacts. While the synthesis relays that little standardization exists as to how this process should occur, it does provide a succinct list of best practices employed by STAs to mitigate utility and highway conflicts.

- *ACRP Synthesis 34: Subsurface Utility Engineering Information Management for Airports* (Anspach and Murphy 2012)
  - This synthesis describes how the understanding of utility management and coordination is important across various modes when it comes to potential impacts that utility can have on projects and operations. It also illustrates that there are numerous methods of identifying utility facilities, but early involvement of those with utility knowledge and proper understanding of location methods and such management approaches as SUE provides the best environment for managing utility conflict situations.

- ASCE 38-02: "A Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data" (2002)
  - STAs use this fundamental document and compliance standard to assess the risk and quality level location procedures as part of using SUE. This document provides guidelines for how to collect utility information according to SUE levels and how this information should be depicted in standardized means. The quality levels are described and illustrated and their relative costs and benefits are also relayed.

- *NCHRP Synthesis 462: Managing Longitudinal Installations on Controlled Access Highway Right-of-Way* (Kraus 2014)
  - This synthesis investigates STA management of the specific situation of longitudinal utility installations on controlled access highway right-of-way. Interestingly, many conclusions of the research herein meld with the conclusions of *NCHRP Synthesis 462*. STAs often have procedures and practices to deal with these instances, but there seems to be a void for a national standard of practice. The use of utility corridors, shared trench methods, and

utility right-of-way accommodations are mentioned as strategies, but procedures and policies for the best use of these practices are minimal.

These resources were used collectively to develop the survey questionnaires and synthesize the information into the following chapters.

CHAPTER THREE

RESULTS OF UTILITY COORDINATION SURVEYS

This chapter provides information on current utility coordination methodologies in use at STAs. It synthesizes the responses of the STAs and outside stakeholders and their outlook on utility coordination. The focus areas described for this research include the following:

- Identification of utility coordination processes
- Identification of the core elements that make utility coordination effective
- Applied research practices and results in utility coordination
- Training and certification available and/or required for utility stakeholders
- Stakeholder integration into the utility coordination processes.

The initial focus of the chapter will be on the STA responses to the survey questionnaire. Then, the non-STA responses will be folded into the STA responses as applicable. Last, any remaining pertinent information from the non-STA stakeholders will be presented and conclusions from these results summarized. The categories of questioning are subdivided according to the subheading used within this chapter.

STATE TRANSPORTATION AGENCY UTILITY COORDINATION SURVEY RESPONSES

First, it is important to note the details of the origins of the STA responses. The survey questionnaire for STAs was distributed to the AASHTO Subcommittee on Right-of-Way, Utilities, and Outdoor Advertising Control. Because of turnover and the breadth of this group, additional contact was made to STAs to ensure the survey reached the proper personnel. Responses were collected from 42 states for an 84% response rate, exceeding the minimum NCHRP standard response rate of 80%. Figure 3 represents the geographic trends of the respondents.

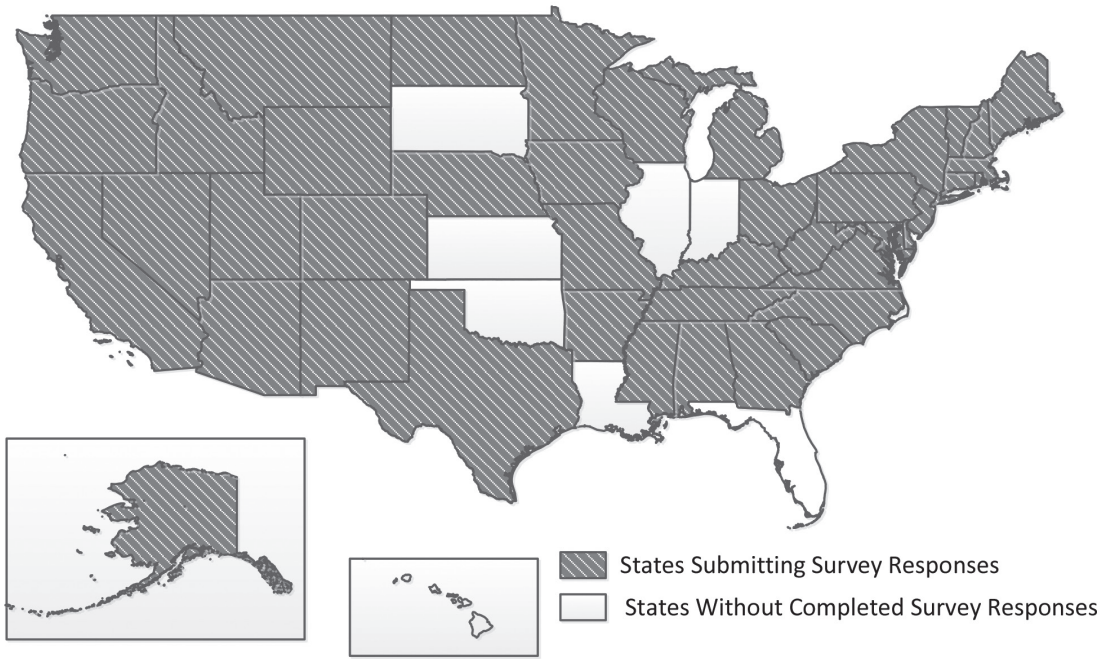

FIGURE 3 Geographic map of survey respondents.

UTILITY COORDINATION PROCEDURES

Timing and Influence

One topic of interest from the STA survey responses relates to the use of procedures and standardization of practices. Also of interest is when particular aspects of the utility coordination process take place and when these aspects become integrated into the project design process. The timing of involvement of utility coordination holds importance in the ability of utility impacts or issues to influence design and vice versa. Construction industry sources report rapidly decreasing cost influence during the design phase of a project, as shown in Figure 4. This supports the assertion of the importance of utility involvement in the project as early as possible.

Further, as recommended by the Arizona Public Improvement Project Model in Figure 5, utility involvement occurs through all phases of a project (Thorne et al. 1993). This theme is also presented elsewhere, for instance as a tenant of the NHI utility coordination training. Although Figure 5 is complex, it shows that the concept of utility coordination as a needed function throughout the project development process has existed for some time. The culmination of these graphics suggests that the earlier a utility owner and/or coordinator becomes involved in the project development process, the better.

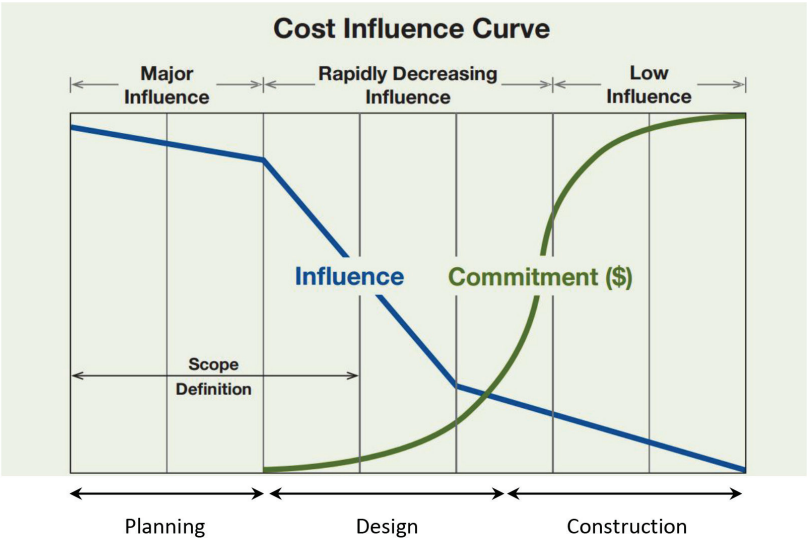

FIGURE 4 Cost influence curve adapted from *Building on 25 Years* (2008).

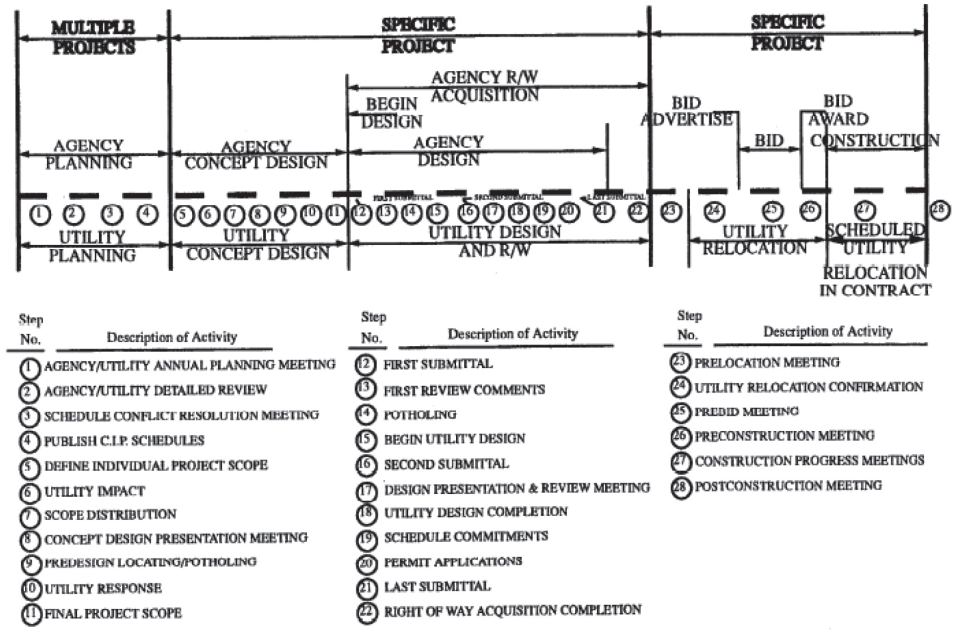

FIGURE 5 Arizona Public Involvement Project Model (Thorne et al. 1993).

The STA survey results, Figure 6, indicate that while 49% of respondents abide by these recommendations, over 50% do not. This could be an easy area for improvement for the respondents who typically do not begin the utility coordination process until the project is 30% designed or later.

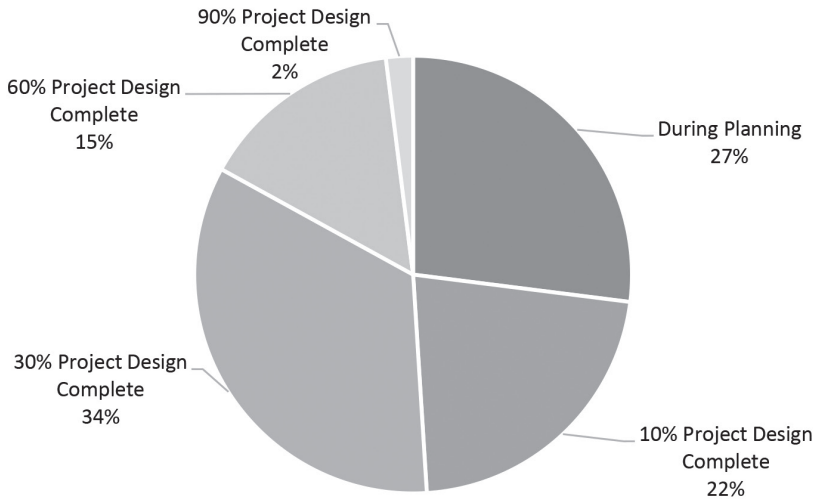

FIGURE 6 Survey responses of initialization of utility coordination.

Related to seeking early coordinated involvement of all stakeholders, Table 3 summarizes results of respondents who were asked about the utility coordination process, the parties involved, and when their involvement occurs. The results indicate that, in some cases, designers and design managers are not involved in the utility coordination process from the start. Additionally, right-of-way agents appear involved much later in the utility coordination process. The dark gray shaded cell indicates the highest response rate for a particular stakeholder and the medium gray shading indicates the second-highest response rate. These responses indicate that the utility owners and right-of-way personnel potentially should be involved earlier in the utility coordination process. In some STAs, project design managers could be involved earlier in the process as well.

TABLE 3
INVOLVEMENT DURING UTILITY COORDINATION BY PARTY

Stakeholders	Utility Coordination Process Percent Complete (From identified conflicts through relocation)					Total Response Count
	Start	10%	30%	60%	90%	
Utility Owners	19	36	24	21	0	42
Project Design Managers	66	5	22	7	0	41
Project Design Consultants	48	25	23	5	0	40
ROW Agents/Managers	28	10	31	23	8	39
Location Services	24	30	41	5	0	37
Utility Designers	8	19	32	38	3	37
Utility Contractors	3	6	14	25	53	36
In-House Designers	49	23	23	6	0	35
Construction Personnel	3	9	18	21	49	33
District Utilities*	100	0	0	0	0	1
Utility Leader/Coordinator*	100	0	0	0	0	1
SUE*	0	100	0	0	0	1
District Utility Coordinator*	0	0	100	0	0	1

***Other stakeholders entered by respondents.**
= Most popular responses per stakeholder = Second most popular responses per stakeholder

Process and Standardization

Another area of interest involves process standardization. One hundred percent of the respondents have documented procedures for utility coordination. Respondents were asked to rank the terms "interactive," "proactive," and "reactive" in describing their utility

coordination processes. It is promising to note that "reactive" was the lowest-ranked term, although there is room for improvement because "interactive" was the predominant descriptor but "proactive" would be optimal. These rankings are seen in Figure 7.

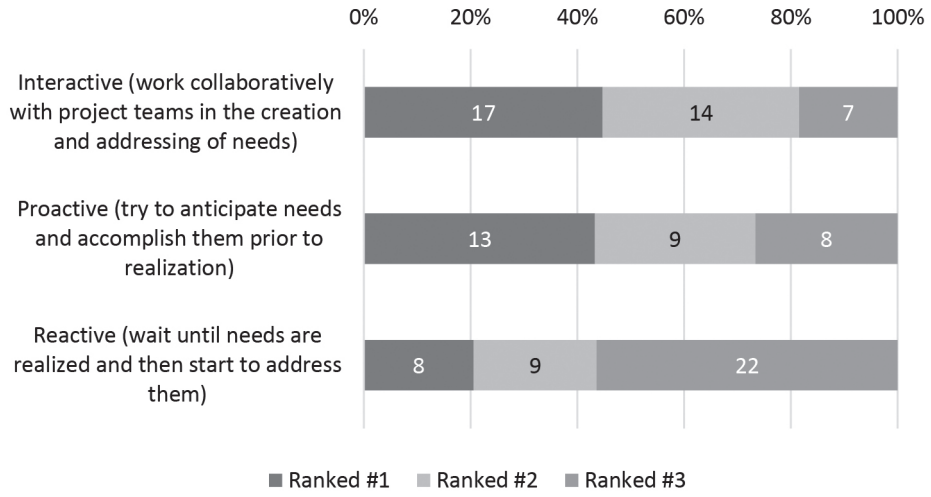

FIGURE 7 Ranking of terms to self-describe STA utility coordination process.

Beyond their processes, STAs were queried on their organizational structure. Figure 8 indicates the variation of how STAs manage utility coordination within differing business units. These results, coupled with the processes predominantly being termed "interactive," indicate that although organizational structures may vary, their approach to conducting utility coordination holds similarities.

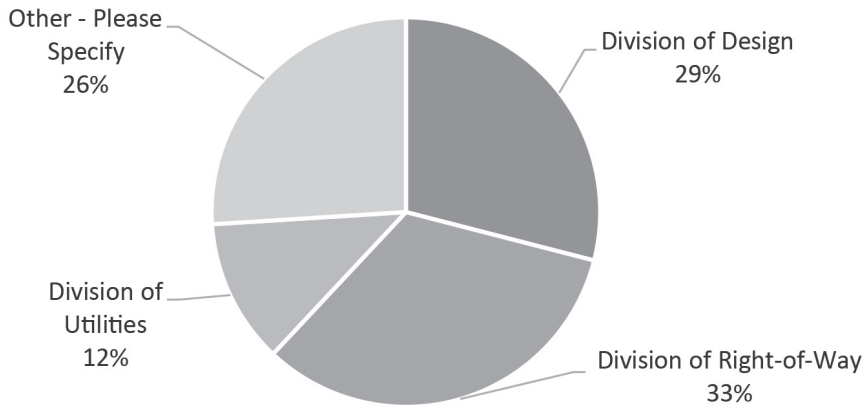

FIGURE 8 Utility coordination business unit location.

In addition, business unit location can be indicative of manpower, influence, or even perceived importance as part of an overall process. While specific conclusions drawn from this figure about an STA's view of the importance of utility coordination as part of the project development process would be founded on opinion, it is clear there is a lack of consensus among states as to the optimal organizational structure to manage this process. Some of the areas within the "Other" category included construction and permitting divisions.

Along similar lines, respondents report further variation within STAs. As seen in Figure 9, the majority of responding STAs operate differently at the local/regional/district level versus the statewide/central office level. This creates additional complexity and potential confusion for non-STA stakeholders, which leads to difficultly in implementing a previous recommendation as outlined in the SHRP 2 R15B Final Report for STAs and utility owners to understand one another's business processes. However, 86% of respondents stated there was a single point of contact at the STA for utility coordination of a specific project.

These responses indicate room for improvement if in fact a more "proactive" and standard approach to utility coordination is considered effective.

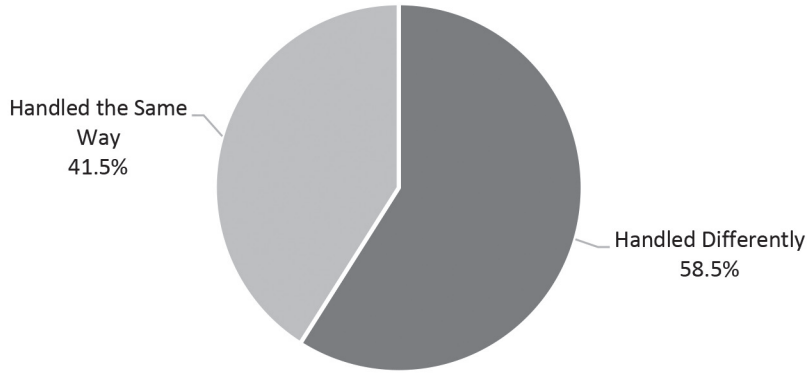

FIGURE 9 STA response on utility coordination being handled differently at local versus statewide levels.

CORE ELEMENTS OF EFFECTIVE UTILITY COORDINATION

Further delving into particular aspects of effective utility coordination, the survey asked respondents to rank their effectiveness on "Timely Utility Involvement on the Project," "Utility Coordination Communication," "Utility Relocation/Alignment Is Considered Within Design Decisions," "Minimized Utility Relocation Cost," and "Timely Utility Relocations." These practices were collected through the literature review and summarized into a succinct generalized list. The responses are seen in Figure 10 and relay that communication, timely involvement, and utility consideration within design are areas where STAs are most effective.

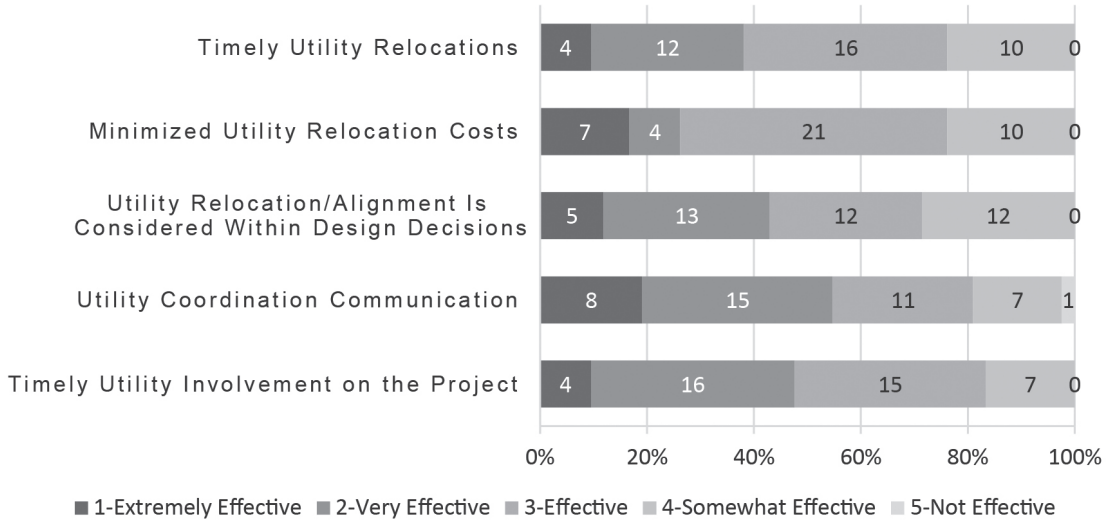

FIGURE 10 Effectiveness of selected utility coordination practices.

When asked whether their STA measured utility coordination effectiveness, 53% responded they "Do Not Measure Utility Coordination Effectiveness," as seen in Figure 11. While it is likely that many STAs use some anecdotal measure, the survey results relay that many STAs do not have performance measures in place to track and improve utility coordination practices. During the case examples, more details were gathered that reveal how effectiveness in utility coordination is measured. This response does present a possible need for more formalized measures of utility coordination effectiveness.

Regardless of specific measures for effectiveness, STA respondents did describe what practices they considered effective by experience, as seen in Figure 12. It is important to note the respondents were only allowed to select the top eight choices from the practices they considered most effective. As can be seen from the definite break following "Identify and Plan for Long-Lead Items," there is consensus for the top eight effective practices.

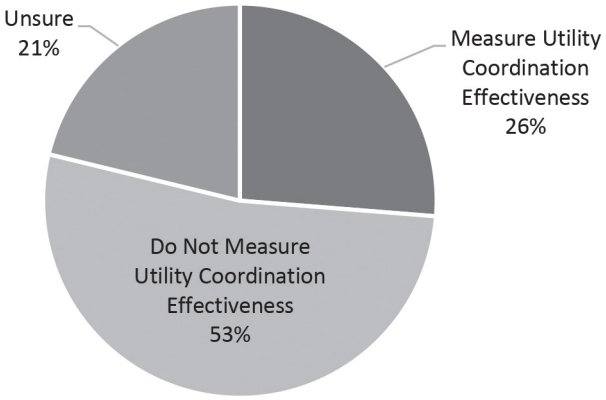

FIGURE 11 Is there an STA measure of utility coordination effectiveness?

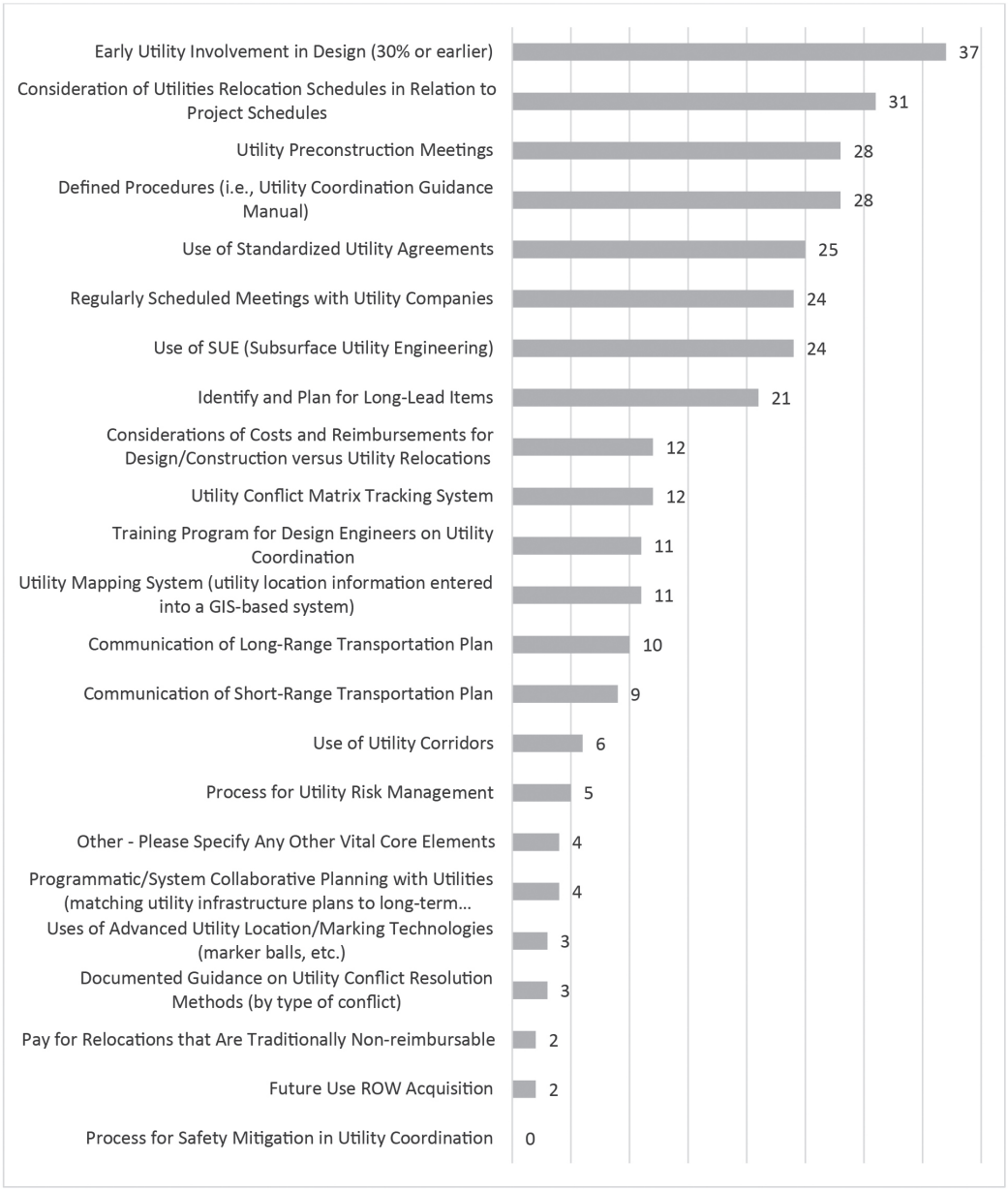

FIGURE 12 Top effective utility coordination practices selected by STAs.

Figure 13 differs slightly from Figure 12 in that STAs were asked to indicate all the practices they use or could use within utility coordination. These responses indicate that some STAs have several more options at their disposal. The responses also potentially illustrate what research and technologies have been readily adopted and put into practice. For example, utility conflict tracking (SHRP 2 R15B Utility Conflict Matrix) was listed frequently. In addition, these responses also correlate to those of Figure 12 in that if an STA does not use a particular practice, they likely would not consider it within their list of effective practices. For instance, the advanced location technologies, such as marker balls, do not appear to be readily adopted, so the low frequency of market balls being listed an effective practice is likely related to the freshness of the technology and not its ability to add value.

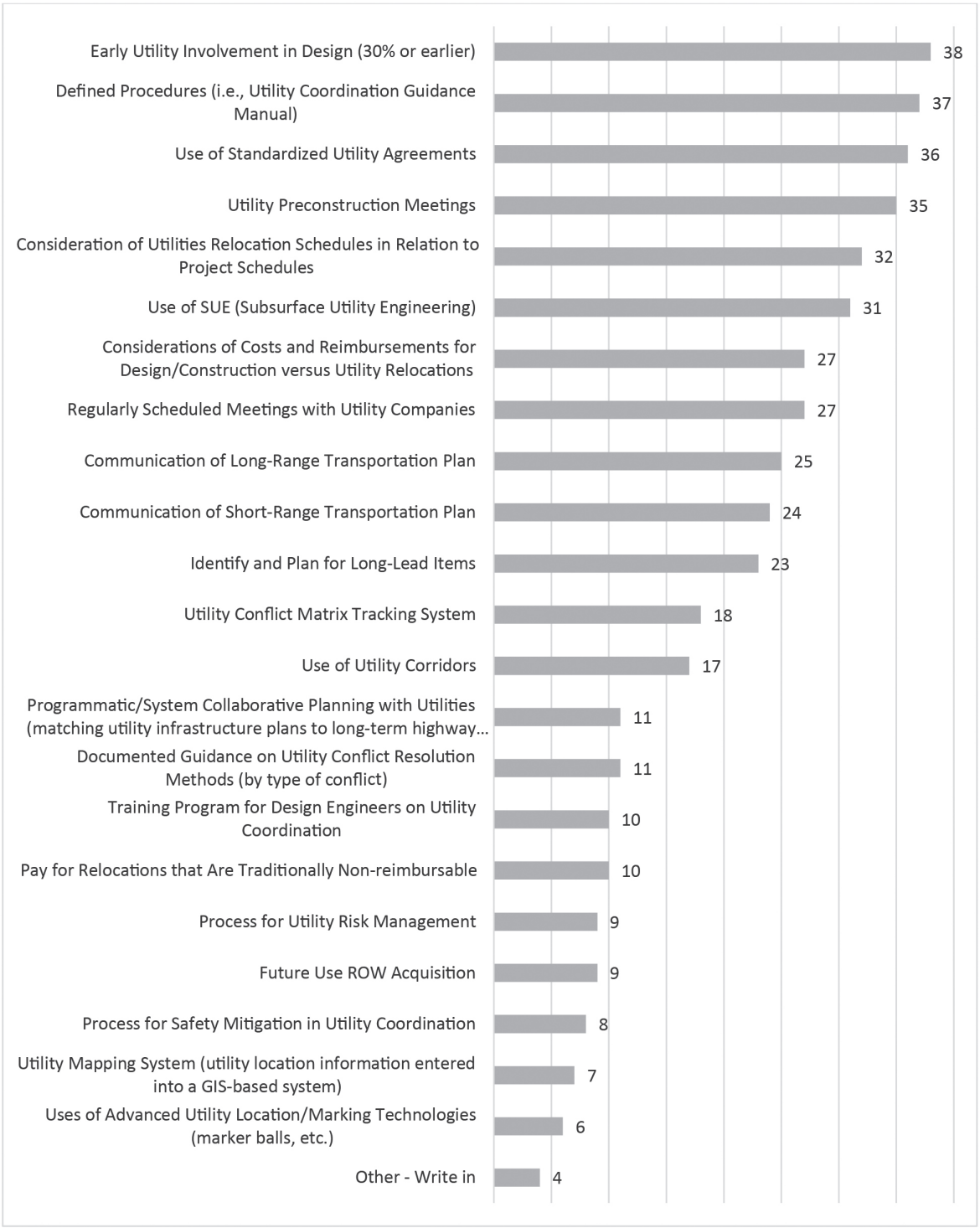

FIGURE 13 Utility coordination practices used by STAs.

Setting Utility Coordination Scope

The survey also sought to determine how STAs set the scope of utility coordination involvement for a project; that is, what project characteristics lead to increased utility coordination involvement. The STA respondents reported that 90% have a documented process for determining the utility coordination scope of a project. Table 4 highlights what factors STAs believe are important when determining scope. This information may also assist STAs in prioritizing a project's utility coordination.

TABLE 4
IMPORTANT FACTORS FOR DETERMINING UTILITY COORDINATION SCOPE

Overall Rank	Item	Average Rank by Respondents	Total Response Count
1	Project Schedule	2.40	40
2	Type of Utilities Involved	3.56	39
3	Level of Utility Risk	4.17	41
4	Number of Utilities Involved	4.19	37
5	Level of Coordination Effort	4.87	38
6	Project Classification (new route, road widening, resurfacing, etc.)	5.67	39
7	Number of ROW Parcels Involved	6.26	39
8	ROW Parcels Type (residential, commercial, urban, rural, etc.)	6.72	39
9	Location Classification (urban versus rural)	6.92	38

Use of Consultant-Led Utility Coordination

Related to project prioritization and resource allocation, the survey asked about STAs' use of consultant-led utility coordination. This practice is gaining traction in the industry and the survey responses may indicate causes of its increased use. As seen in Figure 14, 71% of the respondents are using some form of consultant-led utility coordination. Figure 15 illustrates the contract arrangements in place for respondents using consultant-led utility coordination: if the utility coordination is a separate agreement with a consultant solely for utility coordination, if the utility coordination is part of the design consultants' agreement, or both.

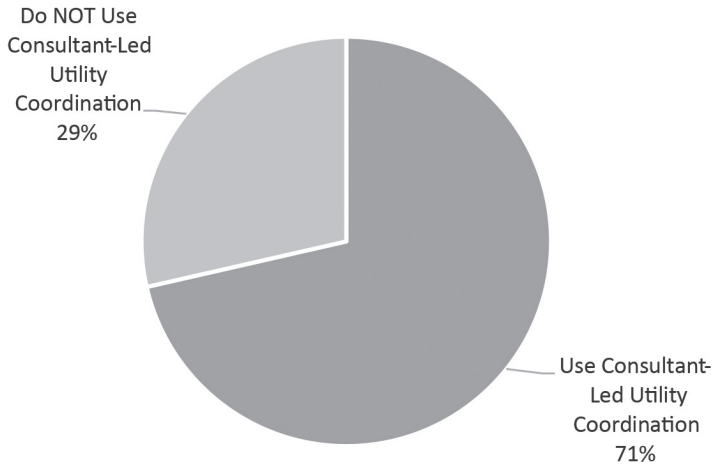

FIGURE 14 STAs and consultant-led utility coordination.

While these figures illustrate the current level of use regarding consultant-led utility coordination, Figures 16 and 17 present the level of satisfaction in using consultant-led utility coordination. When comparing these figures, stand-alone consultant-led utility coordination achieves a higher rate of satisfaction than utility coordination as part of the design consultant's agreement. This is further discussed as part of the case examples, and utility coordination experience appears to be a factor.

Further responses about consultant-led utility coordination indicated that 57% of those who use it require some level of prequalification to manage the process and 67% of those who use it evaluate the utility coordination efforts. Figure 18 illustrates how STAs typically manage their consultant-led utility coordination agreements.

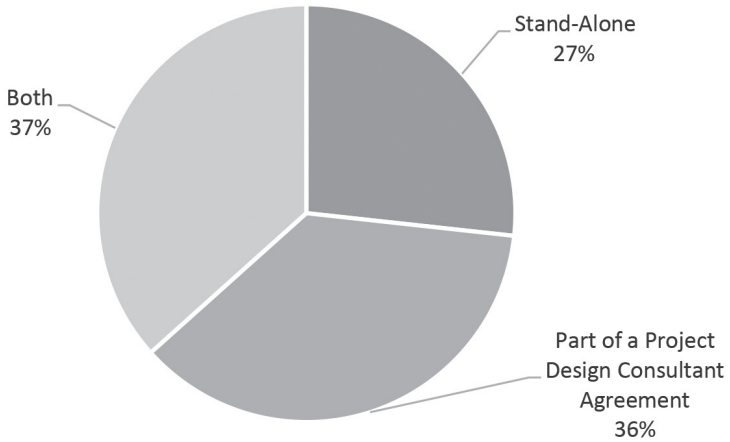

FIGURE 15 Consultant-led utility coordination by contract type.

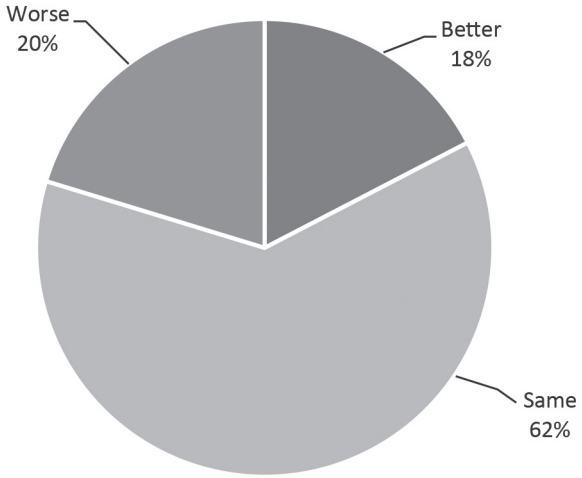

FIGURE 16 Satisfaction with stand-alone consultant-led utility coordination.

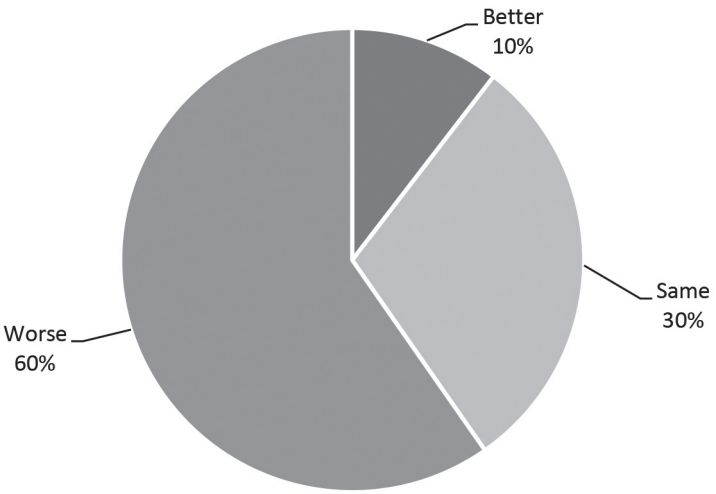

FIGURE 17 Satisfaction with consultant-led utility coordination as part of the design consultant agreement.

Finally, one of the most important aspects of consultant-led utility coordination is why STAs choose to use it. Figure 19 presents a reasoning breakdown; as expected, the predominant reason for choosing consultant-led utility coordination is resources.

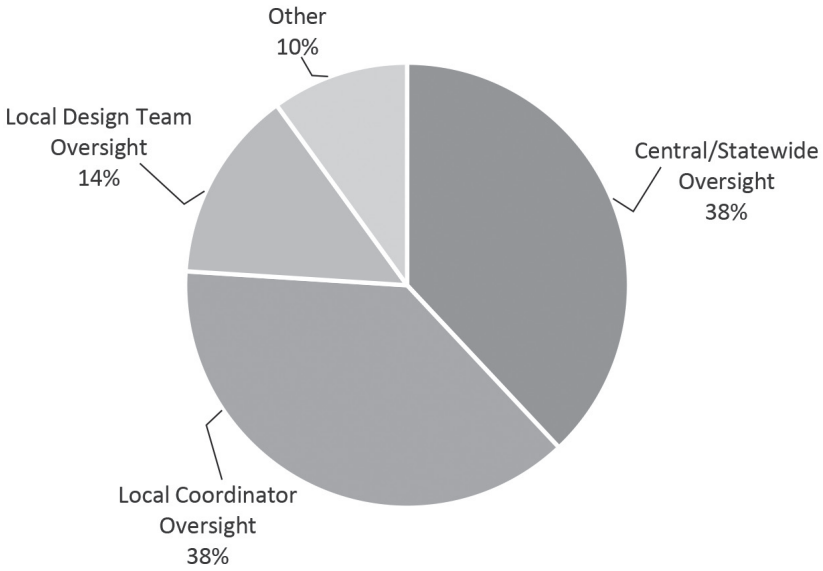

FIGURE 18 STA management of consultant-led utility coordination.

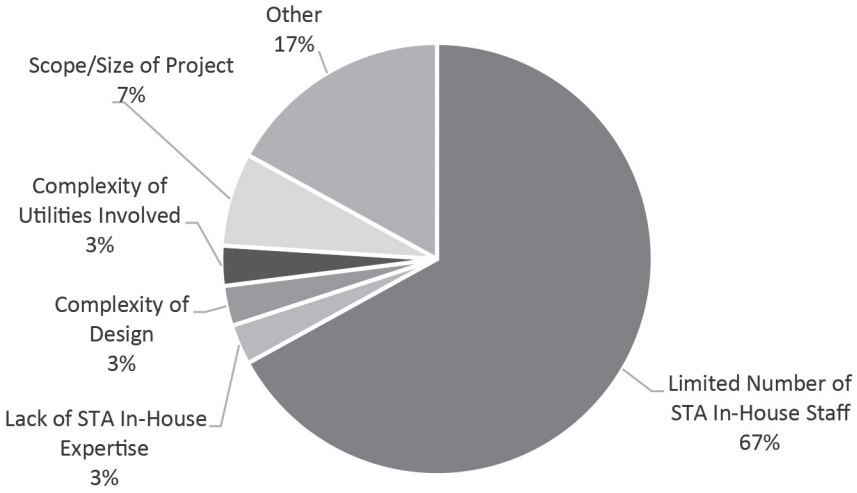

FIGURE 19 STA reasons for using consultant-led utility coordination.

DESIGN-BUILD

In a related subject, as design-build project delivery becomes more prevalent, consultant-led utility coordination may become more prevalent. This may further necessitate training and certification/prequalification to consultants. The survey asked respondents for their opinion of utility coordination on alternatively delivered projects (via design-build, public-private partnerships, construction manager/general contractor, etc.), compared with traditional design-bid-build projects. Responses for STAs and utility owners are found in Figure 20 and Figure 21, respectively.

When asked for additional details, several respondents indicated they maintain utility coordination responsibilities within these contracting methods. The responses indicated there were opportunities for improvement regarding utility coordination for alternatively delivered projects.

EDUCATION, TRAINING, AND CERTIFICATION IN UTILITY COORDINATION

Education, training, and certification are areas of need especially in regard to the use of consultant-led utility coordination. Respondents were asked about their knowledge of any educational opportunities in utility engineering or utility coordination at the trade,

technical, or university level. Eighty-eight percent did not believe those opportunities existed and the remaining 13% were unsure. Further investigation found that while some technical and trade related programs exist, very few are specific to utility coordination functions required by the STAs. As mentioned in chapter two, FHWA offers a resource website and NHI offers two related trainings. Further resources may soon become available through the recently established ASCE-UESI, as also noted in chapter two.

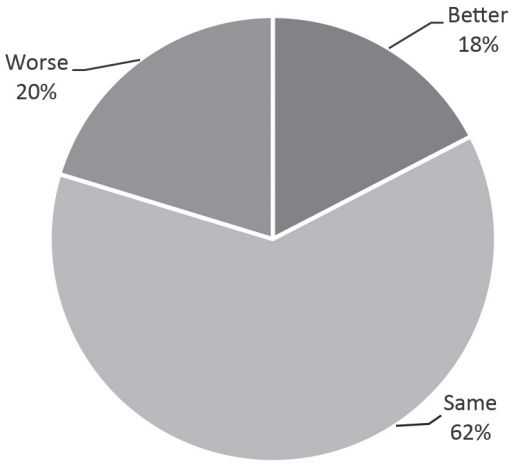

FIGURE 20 STA opinion of utility coordination on alternatively delivered projects compared with design-bid-build.

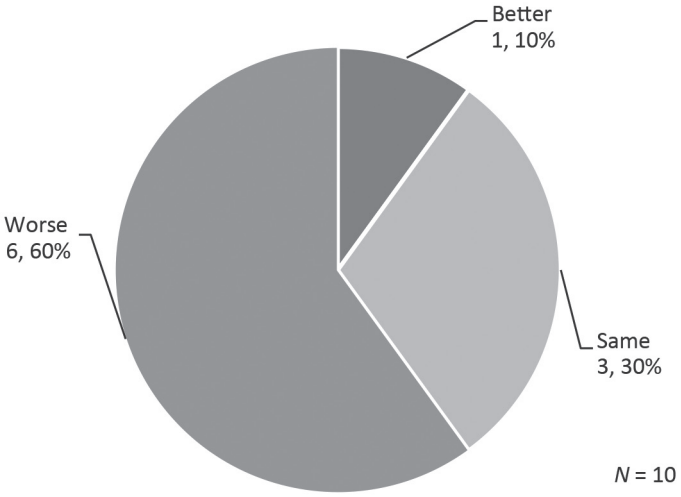

FIGURE 21 Utility owners' opinion of utility coordination on alternatively delivered projects compared with design-bid-build.

As previously noted, resource constraints and knowledge loss within the STA could lead to the increased use of consultants to conduct utility coordination. Although education opportunities are few, utility coordination training offered by STAs attempts to fill that void. The responses show that 20% of the STA respondents offer or require training or certification in utility coordination; however, 57% of the STAs that use consultant-led utility coordination require prequalification or certification to conduct such tasks. Stemming from these responses and the STA responses about those for whom they offer utility coordination training (Figure 22), STAs considering consultant-led utility coordination may need to first develop a utility coordination certification program or at least expand the availability of their utility coordination training to consultants.

LEGISLATION, REGULATIONS, AND GUIDANCE

Many utility coordination professionals are concerned about consistency within utility-related legislation, regulations, and guidance. Figure 23 and Figure 24, respectively, illustrate STA and non-STA responses about consistency within federal and local

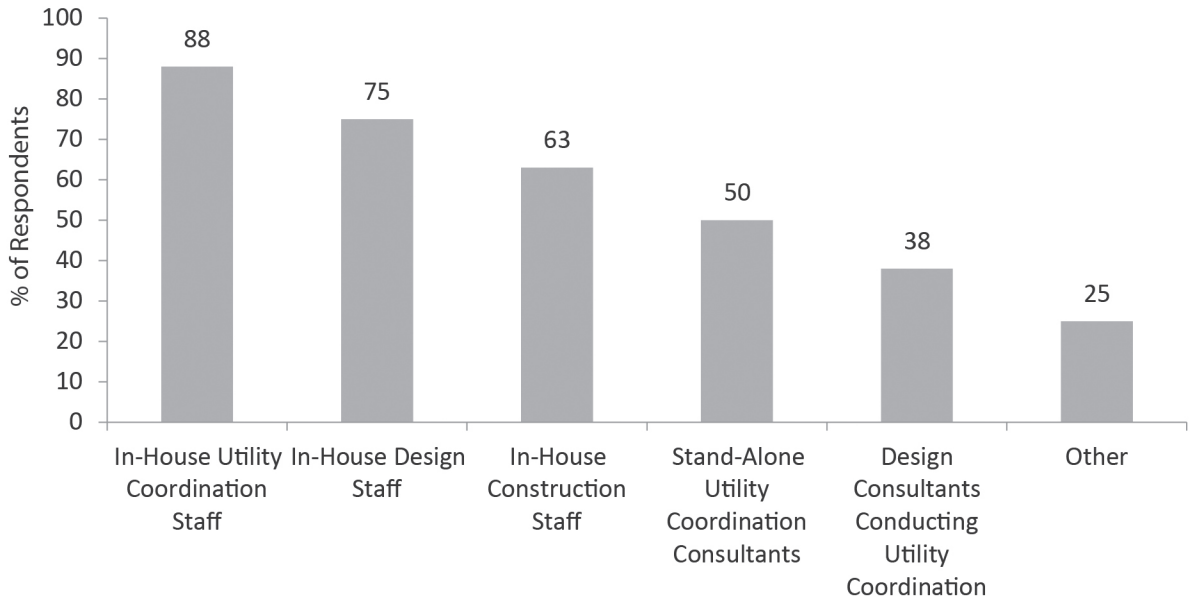

FIGURE 22 Groups offered STA utility coordination training.

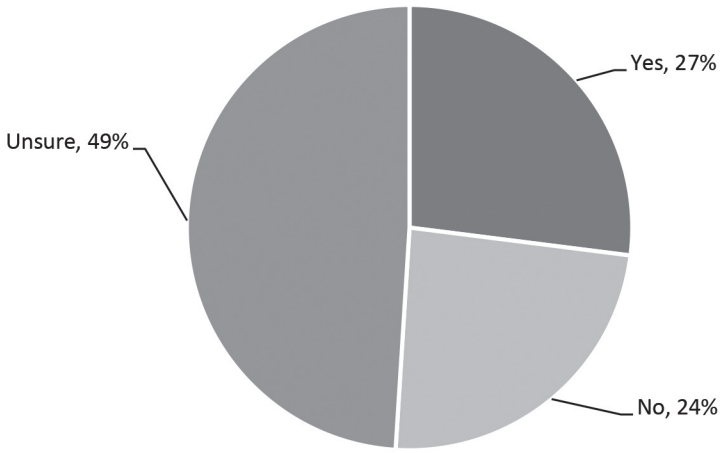

FIGURE 23 STA responses to consistency in federal and local legislation and regulations.

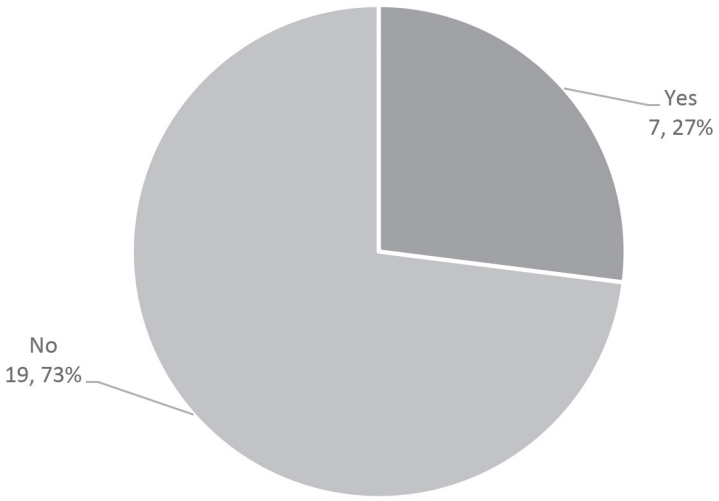

FIGURE 24 Non-STA responses to consistency in federal and local legislation and regulations.

legislation and regulations for utility coordination. Of note, the utility owners, who likely must operate across state boundaries, indicated a higher rate of inconsistency in legislation and regulations. Further investigation into legislation, regulations, and guidance does indicate a level of variance in utility coordination. According to the *Program Guide: Utility Relocation and Accommodation on Federal-Aid Highway Projects* (2003), the STAs can define various criteria in their accommodation, relocation, and reimbursement policies. One example is what facilities are being defined as a utility. Some states view certain telecommunications as a "utility" while others do not (*Program Guide: Utility Relocation and Accommodation on Federal-Aid Highway Projects* 2003). This inconsistency also affects cellular towers, renewable energy facilities, and fiber optics. Consideration as a utility or not affects aspects of accommodation, relocation, and reimbursement regarding that facility. In addition, the NHI training workbook for the course *Utility Coordination for Highway Projects* relays that STAs have specific accommodation policies as approved by FHWA. These policies must be at least as stringent as federal guidelines; alterations may be allowed with local FHWA approval. States also determine their own relocation, reimbursement, and longitudinal access policies and legislation. Owing to the potential for 50 states to have 50 varying policies, justifiable concern exists about consistency within utility coordination.

Follow-up survey responses indicated that the Buy America Act as it applies to utilities is a point of concern for multiple STAs. Questions about the Buy America Act were incorporated into the case examples, and further details can be found in chapter four of this report. Additional concerns included penalty and incentive use for timely utility relocations and federal restrictions on reimbursing engineering costs prior to agreements. These issues all vary by state.

STAKEHOLDER INTEGRATION IN UTILITY COORDINATION

Some lines of questions for the non-STAs did not manifest themselves for easy discussion into the STA responses previously reported. There were 29 non-STA stakeholder responses including 16 respondents who were utility owners/owners. The breakdown of the 29 responses is seen in Figure 25. For the total group, the involvement of these stakeholders tends to begin prior to the 30% Project Design Complete milestone (from Figure 26). However, utility owners generally are involved later in the design process. This presents an area for concern. Figure 27 illustrates the utility owner involvement point from utility owner respondents.

Similar to the STA line of questioning, non-STAs were asked to choose their top eight elements to include in utility coordination practices. The results are summarized in Table 5 along with STA results. The responses indicate the top four elements are well aligned across the groups. The shaded elements have variation across the groups of more than 30%.

As before, the same list of elements was provided for the respondents to indicate which practices they had the capability to use or had witnessed being used. The results are summarized in Table 6 along with STA results. The shaded elements again have more than 30% variation across the groups. Notably, in comparing these tables, the highest-rated practice as well as the practice most commonly available to STAs is Early Utility Involvement in Design (30% or earlier).

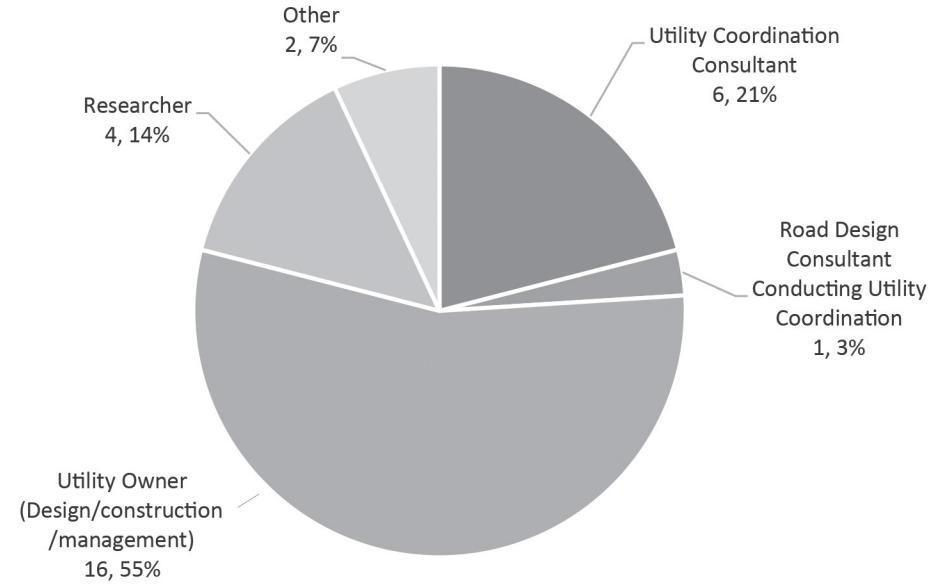

FIGURE 25 Non-STA survey respondent groups.

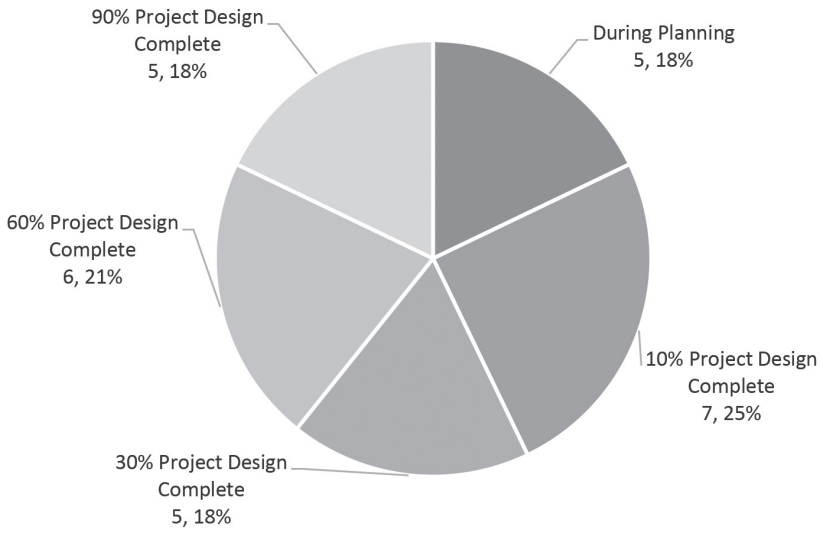

FIGURE 26 Non-STA stakeholder utility coordination involvement point.

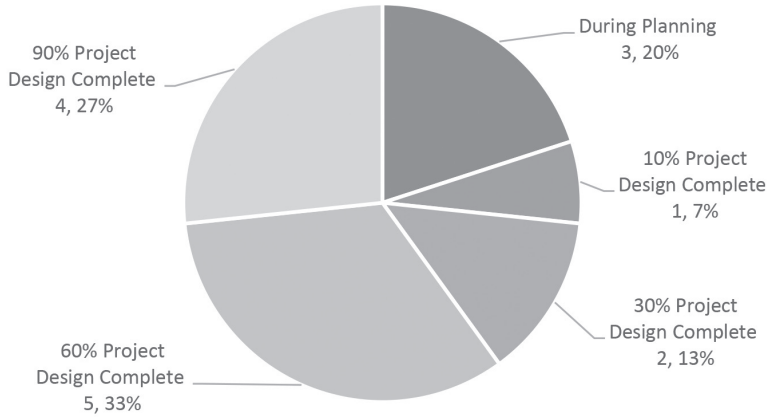

FIGURE 27 Utility owner utility coordination involvement point.

TABLE 5
COMPARISON OF TOP SELECTED CORE ELEMENTS FOR EFFECTIVE UTILITY COORDINATION PROCESS

Element	Percent of STA Respondents Selected ($n = 42$)	Number of Non-STA Respondents Selected ($n = 29$)	Number of Utility Owners Selected ($n = 16$)
Early Utility Involvement in Design (30% or earlier)	88 ✦	26 ✦	15 ✦
Utility Preconstruction Meetings	67 ☆	20 ✦	12 ✦
Defined Procedures (i.e., Utility Coordination Guidance Manual)	67 ✦	17 ✦	8 ☆
Consideration of Utilities Relocation Schedules in Relation to Project Schedules	74 ✦	15 ☆	10 ✦
Use of SUE (Subsurface Utility Engineering)	57 ☆	13 ☆	2
Regularly Scheduled Meetings with Utility Owners	57 ☆	12 ☆	5
Communication of Short-Range Transportation Plan	21	12 ☆	9 ☆
Use of Utility Corridors	14	12 ☆	8 ☆
Use of Standardized Utility Agreements	60 ☆	8	6
Identify and Plan for Long-Lead Items	50 ☆	4	0
Utility Mapping System (utility location information entered into a GIS-based system)	26	10	7 ☆
Communication of Long-Range Transportation Plan	24	10	7 ☆

✦ = Top three elements selected by respondents. ☆ = Top eight elements selected by respondents.

TABLE 6
COMPARISON OF TOP SELECTED ELEMENTS AVAILABLE FOR UTILITY COORDINATION

Element	Percent of STA Respondents Selected ($n = 42$)	Number of Non-STA Respondents Selected ($n = 29$)	Number of Utility Owners Selected ($n = 16$)
Early Utility Involvement in Design (30% or earlier)	91 ✦	25 ✦	14 ✦
Utility Preconstruction Meetings	83 ☆	25 ✦	14 ✦
Use of Utility Corridors	41	20 ✦	12 ✦
Regularly Scheduled Meetings with Utility Owners	64 ☆	17 ☆	8 ☆
Communication of Short-Range Transportation Plan	57	17 ☆	10 ☆
Defined Procedures (i.e., Utility Coordination Guidance Manual)	88 ✦	15 ☆	7 ☆
Use of SUE (Subsurface Utility Engineering)	74 ☆	15 ☆	4
Use of Standardized Utility Agreements	86 ✦	14 ☆	8 ☆
Considerations of Costs & Reimbursements for Design/Construction versus Utility Relocations	64 ☆	12	4
Consideration of Utilities Relocation Schedules in Relation to Project Schedules	76 ☆	11	6
Future Use ROW Acquisition	21	14	10 ☆
Communication of Long-Range Transportation Plan	60	13	7 ☆

✦ = Top three elements selected by respondents. ☆ = Top eight elements selected by respondents.

FIGURE 28 Non-STA effective utility coordination practices (limited to choosing top eight).

The results of which effective practices non-STA respondents have witnessed on projects is found in Figure 29, while Figure 28 relays the non-STA responses when limited to selecting the top eight practices. Of note, Training Program for Design Engineers on Utility Coordination is considered important but is not commonly used. Table 4, Table 5, Figure 28, and Figure 29 (especially when compared with Figures 12 and 13) communicate very valuable information about STA and utility company perceptions and their alignment. Some of these points are noted within the conclusions, though the shaded elements of Tables 4 and 5 illustrate areas where utility companies and STAs should discuss strategies for improving utility coordination.

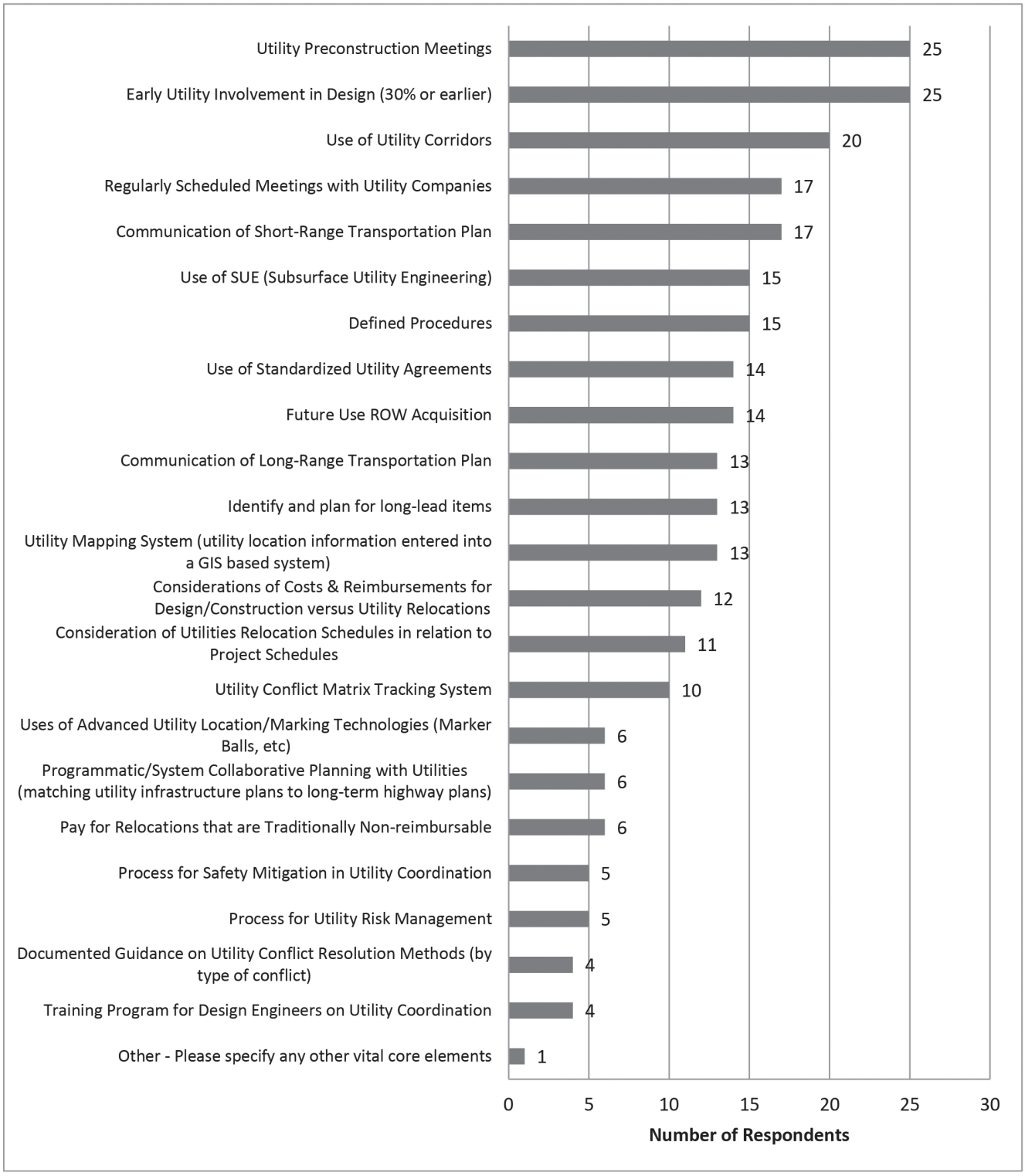

FIGURE 29 Non-STA utility coordination practices witnessed on projects.

APPLIED RESEARCH AND RESULTS IN UTILITY COORDINATION

Implementation of various utility coordination research has previously been presented; however, there was particular interest in the SHRP 2 utility coordination products. Table 7 notes the respondents' use of those products, and indicates that the STAs are making substantially more use of SHRP 2 R01B and SHRP 2 R15B than SHRP 2 R01A. This seems to align with the information previously presented and the conclusions of the case examples presented later.

TABLE 7
STA IMPLEMENTATION OF THE SHRP 2 UTILITY PRODUCTS

	None	Little	Some	Complete	Unsure	Total Response
SHRP 2 R01A: 3D Utility Location Data Repository—technologies that support, store, retrieve, and use 3D utility location data	**60%** 25	**14%** 6	**19%** 8	**2%** 1	**5%** 2	42
SHRP 2 R01B: 3D Utility Investigation Technologies—the advanced application of SUE through combining multiple technologies (multi-channel ground-penetrating radar, time domain electromagnetic induction, etc.) based on soil type, utility material, terrain type, and other features	**29%** 12	**12%** 5	**45%** 19	**5%** 2	**10%** 4	42
SHRP 2 R15B: Identifying and Managing Utility Conflicts—the development and use of a utility conflict matrix and database system to manage utility conflicts throughout the design and construction	**31%** 13	**10%** 4	**36%** 15	**17%** 7	**7%** 3	42

With regard to the topics in need of research within utility coordination, Figures 30 and 31 present the needs of the STA and non-STA respondents, respectively. Respondents were asked to select their top three choices. The results show consistency between the STA and non-STA responses and indicate an interest in advancing SUE, location technologies, and standardization of utility coordination procedures.

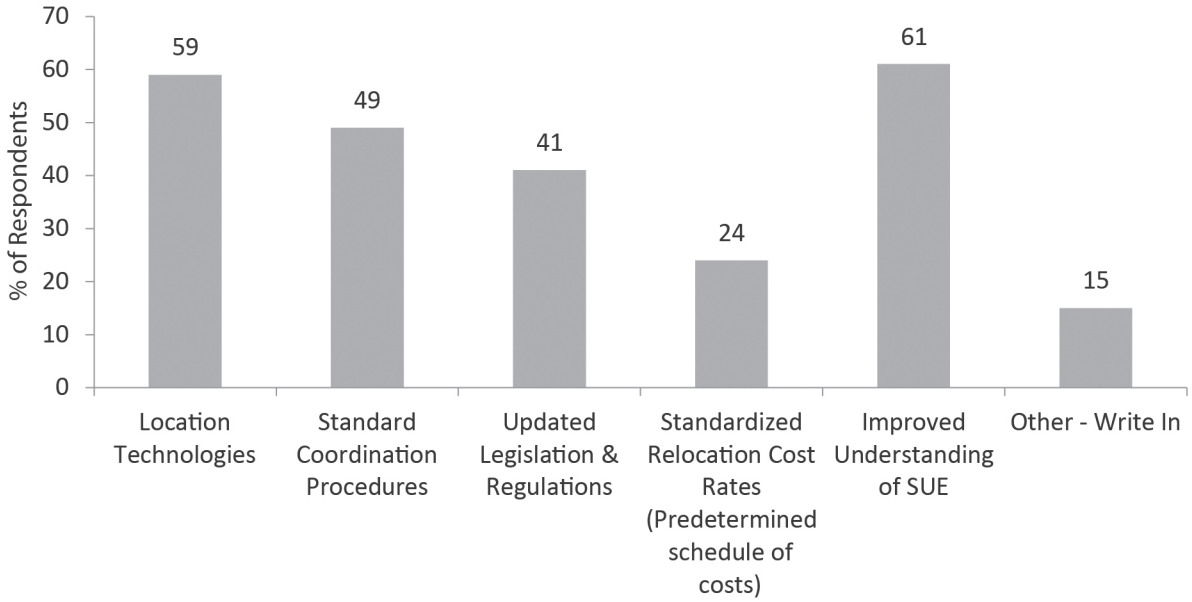

FIGURE 30 STA-indicated areas of need for utility coordination research (limited to choosing top three).

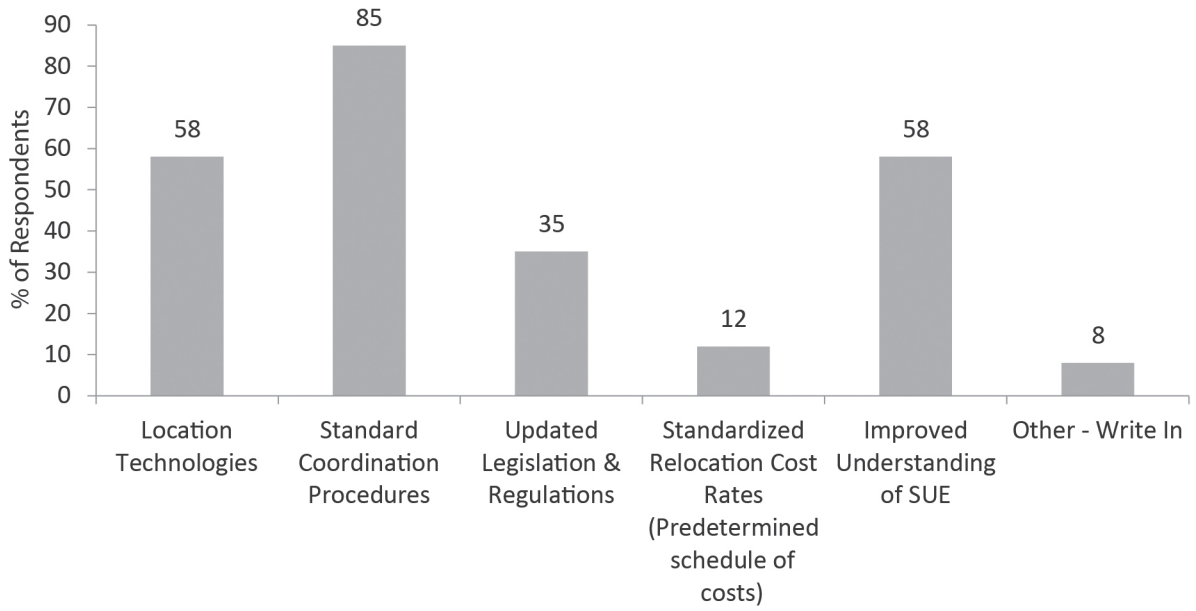

FIGURE 31 Non-STA-indicated areas of need for utility coordination research (n = 26; limited to choosing top three).

Key issues presented above are further investigated in the case example interviews discussed in the following chapter.

CHAPTER FOUR

RESULTS OF UTILITY COORDINATION CASE EXAMPLES

This chapter describes the STA case examples that were based on the initial survey results. These follow-up interviews will help other STAs develop or enhance their utility coordination procedures. The states selected for these interviews/case examples were Kentucky, Maryland, Utah, Virginia, Washington, and Wyoming. The interviews were conducted in person, which allowed for very detailed, rich discussion. The topics of conversation centered on the following points:

- Utility Coordination Best Practices and Implemented Research
- Consultant-Led Utility Coordination
- Availability of Utility Education and Training
- Knowledge Gaps Associated with Utility Coordination.

The interview candidates were selected according to the following criteria, in order of precedence:

1. The STA indicated they were willing to be interviewed.

2. The STA's self-rating of their performance (proactive, interactive, reactive); selected to achieve a cross section.

3. The STA's self-rating of effectiveness on their use of timely utility involvement, utility coordination and communication, utility relocation/alignment is considered with design decisions, minimized utility relocation costs, and timely utility relocations.

4. The STA's use of SHRP 2 products according to the number of products used.

5. Whether the STA uses consultant-led utility coordination; selected for an even distribution of yes and no responses.

6. Selected to achieve regional diversity.

GENERAL FINDINGS

It seemed in the best interest of the interviewees to report some findings as general—yet anonymous—statements. The points below summarize those items where the feelings of the interviewees came to a consensus.

- *Utility Coordination as Part of the Design Process:* Communication inefficiencies exist between utility coordinators and transportation designers. Utility coordination is not viewed as a valuable part of the transportation design process. This is evident by a lack of early involvement by utility personnel. Optimal results could be realized with the inclusion of utility coordination as a process that occurs throughout the development of a project (from concept inception).
- *Consultant-Led Utility Coordination:* Often consultant-led utility coordination is used out of necessity but it is not an entirely effective process if not used judiciously. Consultants turn to the STA with any unexpected issue or concern, which re-involves the STA in the process they were attempting to outsource. Also, legality issues could arise if consultants do not have the statutory authority to make utility coordination decisions. In some cases, the utility owners would rather coordinate with the STA, and although STAs have provided contact points to resolve these concerns, creating multiple contact points of coordination (consultant coordinator and STA coordinator) creates confusion and often inconsistency. Additionally, issues can arise if consultants who are performing coordination tasks have any previous or new business relationships with the utilities they are relocating.
- *Buy America Act:* The Buy America Act creates cause for concern and confusion within utility coordination and relocation. The application of the Buy America Act on utility relocations is cumbersome to control and track, and could

be impossible if specialized components are required or quality standards are not met by products made in the United States. FHWA is currently working on guidance and resolution to this issue. Further information can be found at http://www.fhwa.dot.gov/utilities/buyam.cfm and http://www.fhwa.dot.gov/construction/cqit/buyam.cfm.

- *Plan, Schedule, and Budget Accuracy:* A running theme within the survey was also pointed out during interviews: historically, STAs have provided overly optimistic project schedules, as well as inaccurate budgets and plans. While the intent is to provide information as timely as possible, the risk of changes occurring to schedules, plans, and budgets must also be communicated. Because utility owners must budget and schedule relocations, they must prioritize their work and need a sound understanding of the accuracy of the data they are being provided. The inaccuracy trend has led to a lack of confidence in the information provided to utility owners. Couple this with transportation design professionals typically not understanding the nuances of utility coordination and the result is frustration by all parties. These trends need to change with thorough and accurate communication, the melding of the utility and transportation design process, and education and training.

KENTUCKY CASE EXAMPLE

- Utility Coordination Best Practices and Implemented Research

The Kentucky Transportation Cabinet (KYTC) has been making substantial changes to their utility coordination process over the past several years. It initiated a task force to conduct a process review and accumulate tools for improved utility coordination and relocation, sponsored research to streamline the utilities process, became a pilot for SHRP 2 R15B utility conflict matrix (UCM), and entirely revised its policy manual to move toward more consistent practices statewide. All this centers on and is coordinated with its UCM—housed within the Kentucky Utilities and Rail Tracking System (KURTS). A stand-alone case example exists for KURTS that is available through the SHRP 2 website. In following the layout of the new policy manual, KURTS and its associated training is building consistency statewide and starting a tracking system that will be able to monitor performance.

KURTS and associated mobile applications have also incorporated mobile technology into utilities inspection. This information and the information entered by utility owners is available in multiple forms including KYTC's geographic information system (GIS) applications. KYTC's movement is an example of how research and technology adoption may lead to process improvements.

- Consultant-Led Utility Coordination

KYTC has been using transportation project consultants to lead utility coordination, typically as a result of resource constraints. Success has varied and KYTC hopes to develop training to improve understanding of the utility coordination process.

- Availability of Utility Education and Training

KYTC is going to use the NHI training but would like material that is KYTC specific. It is not aware of any available professional curriculum.

- Knowledge Gaps Associated with Utility Coordination

KYTC personnel would like to see more detailed research into consultant-led utility coordination and its associated costs, benefits, and complexities. Likewise, understanding the costs, benefits, and complexities of incorporating utility construction into roadway construction is of interest.

MARYLAND CASE EXAMPLE

- Utility Coordination Best Practices and Implemented Research

The Maryland State Highway Administration (MSHA) begins utility coordination as soon as possible with the start of the design phase. MSHA conducts local utility meetings as needed, regional meetings on a monthly basis, and longer-range meetings with executive-level utility personnel less frequently. It attempts to communicate project likelihood within the long-range

plan; for example, projects with funding allocated for construction versus those with design-only funding. MSHA does not have formal utility performance metrics but it does evaluate whether it must delay claims because of utility conflicts.

MSHA has recently incorporated many changes such as the SHRP 2 R15B utility conflict matrix. It has revamped utility coordination to incorporate the UCM throughout the process, all the way back to project concept (5%–15% design). MSHA is now incorporating utility features before beginning road design and formally discussing the UCM with transportation designers and utility owners at the 30% design stage—nearly 35% earlier in the process. MSHA is currently trying to automate UCM population, since data entry has been very time-consuming. The UCM is now providing a tracking mechanism to work toward improvements.

- Consultant-Led Utility Coordination

MSHA has used consultant-led utility coordination on a few projects. It has seen more success with true consultant-led utility coordination as opposed to utilities being incorporated into a design-build project.

- Availability of Utility Education and Training

MSHA does in-house utility coordination training. The training is rarely offered to consultants.

- Knowledge Gaps Associated with Utility Coordination

MSHA feels a knowledge gap exists due to the lack of standardization and inconsistencies in regulations, laws, and policies regarding utility coordination. This lack of standardization causes difficulty for utility owners, consultants, and contractors working across state lines. State and federal policies should also be analyzed for alignment as these issues are common for smaller, population-dense states as well as for metropolitan areas that cross state lines.

UTAH CASE EXAMPLE

- Utility Coordination Best Practices and Implemented Research

The Utah Department of Transportation (UDOT) starts utility coordination as early as possible and depends on its relationships with utility owners to add value to the utility coordination process. UDOT starts coordination at the scoping phase to get utility records related to the project. It incorporates SUE on every project, up to Level B for most utilities. Based on risk and conflict analysis, UDOT may go to SUE Level A.

UDOT has established partnerships with utility owners that developed over a long period of time and are built on personal relationships. These relationships also help in establishing Master Relocation Agreements. UDOT uses Master Agreements with major utilities and then uses project agreements (supplemental to the Master) for specific project details. This streamlines the development process because it is difficult to renegotiate standard terms in individual agreements. UDOT has not encountered issues with utility owners hesitant to enter Master Agreements, although it does take substantial effort to establish them to the satisfaction of the parties' legal teams. Once established, they become easier to maintain.

UDOT meets regularly with utility owners at the state level (monthly or biannually depending upon the size of utility). It shares upcoming project information with the utility owners, but often the utility owners do not reciprocate. UDOT supplies the utility owners with the best schedule information available and tries to communicate the level of risk associated with those dates. The schedule information is also available online and is updated daily as changes occur.

UDOT uses a two-phased approach to coordinating utilities: design that occurs along with the transportation project design, and construction/relocation coordination during project construction. The rapid pace of project delivery schedules requires this approach. It is beneficial to combine construction operations for greater efficiency. UDOT provides clearing and grubbing, project surveying, maintenance of traffic, traffic control, and site restoration for utility relocations. UDOT sends authorization letters for utility owners to start design at the 30%–40% transportation project design stage and authorization to proceed with construction when relocation agreements are executed. UDOT is also starting to give utilities written notice when the project construction contract is in place, to let them know when the construction/relocation phase will begin. UDOT experiences some difficulty in the transition between the design and construction phase because both UDOT and the utility owners simultaneously go through an internal exchange of project responsibilities. This means that most of the personnel with

intimate knowledge of the project are changing. UDOT does not have utility-specific performance measures, but it does track project utility change orders and payment processing times.

Recently, UDOT adopted a new administrative rule for enforcement that allows it to recoup delay costs if a utility owner is not performing. This rule has not been used to date and UDOT hopes to avoid its use through successful coordination efforts. UDOT has put procedures in place to ensure that the paperwork needed for recouping costs is tracked. It is currently conducting SHRP 2 R15B implementation. It had been using similar systems but then saw some of the automation Kentucky was implementing and wanted to incorporate that into its system. UDOT is going to attempt to tie in its GIS system so conflict identification can occur from an online platform. As UDOT transitions toward 3D design sets and away from paper plans, it hopes to include a 3D viewer in the package to help better identify conflicts.

- Consultant-Led Utility Coordination

UDOT uses in-house forces first and then uses consultants when out of capacity. In UDOT's experience, the utility owners do not like to coordinate with consultants, so UDOT provides a DOT point of contact as part of the consultant coordination.

- Availability of Utility Education and Training

UDOT uses and encourages the NHI Utility Coordination training courses. It also offers internal training courses that follow its manual of instruction according to UDOT demand for the training.

- Knowledge Gaps Associated with Utility Coordination

The UDOT interviewee would like to see training and methods for increased knowledge/understanding and stronger collaboration between utility designers and transportation designers.

VIRGINIA CASE EXAMPLE

- Utility Coordination Best Practices and Implemented Research

The Virginia Department of Transportation (VDOT) maintains communication with the utility industry to stay up to date on projects and project needs. It has formalized monthly meetings in each district with the utilities and attempts to be proactive in addressing issues. VDOT makes use of Master Agreements and has 187 such agreements in place with all the utility owners in Virginia. VDOT emphasizes transparency with all of its project schedules available online. It also attempts to work with the utility owners to prioritize relocations and lets them know as soon as possible whether work is reimbursable. VDOT is moving toward relocating the utilities during the construction phase to ease utility owner and public burdens of multiple projects within the same corridor (will allow utility and transportation contractors to collaborate on activities such as clearing). VDOT places a priority on right-of-way needed for utility relocation and will acquire it for the utility owners when possible. VDOT measures performance through reviews of costs and relocation schedules, which are reported quarterly.

VDOT recently incorporated structured communication and formalized meetings into utility coordination. It has full-time utility relocation inspection across the state, which it has found helpful to the process. It has plan-reading classes to help utilities read transportation plans and tries to streamline the plans and project information given to utilities so they do not receive unnecessary information. VDOT is a pilot state for SHRP 2 R01A and SHRP 2 R01B, and it is also implementing SHRP 2 R15B.

- Consultant-Led Utility Coordination

VDOT does make use of consultant-led utility coordination and resource-based decisions. Owing to the quality of the consultants it uses, VDOT has had successes. But when issues are encountered, VDOT personnel become involved to find resolutions. Additionally, the utility owners are not always willing to cooperate with consultants.

- Availability of Utility Education and Training

VDOT does not have formal utility coordination training and it does not believe much is available. VDOT training relative to utilities tends to be internal, though it has participated in the two NHI classes available for utility coordination. VDOT is

currently developing training for the utility industry on reading transportation construction plans, developing utility relocation plans, and preparing estimates to be submitted for authorization.

- Knowledge Gaps Associated with Utility Coordination

There is a legitimate concern about knowledge loss due to turnover not only at VDOT but nationwide. Designer understanding of the importance of utility avoidance, impacts, and coordination is currently not a trained knowledge base, it is developed on the job. Training for designers and utility personnel alike would be helpful.

WYOMING CASE EXAMPLE

- Utility Coordination Best Practices and Implemented Research

Wyoming Department of Transportation (WYDOT) starts utility coordination with the start of the design phase. It provides project schedules to utility owners. WYDOT conducts local utility meetings to update utilities on project schedules and impacts. Its goal is to have the design ready for letting 18 months in advance, but it is difficult to get utilities to acknowledge this schedule. WYDOT does not have a formal utility performance measure but does attempt to qualitatively track schedule performance in meeting a clearance goal 12 to 18 months before letting.

WYDOT has recently applied for SHRP 2 Implementation funding for the product bundle of R01A, R01B, and R15B. Additionally, WYDOT is working toward online permitting and using GIS for utility locations. The goal is for utility owners to identify locations online.

- Consultant-Led Utility Coordination

WYDOT seldom uses consultant-led utility coordination.

- Availability of Utility Education and Training

WYDOT conducts training in-house for its personnel, utility owners, contractors, and transportation designers.

- Knowledge Gaps Associated with Utility Coordination

WYDOT personnel feel there is a gap in the availability of information specific to utility coordination, policies, and regulations. A useful and readily available national repository would be extremely helpful to STAs and consultants alike.

WASHINGTON STATE CASE EXAMPLE

- Utility Coordination Best Practices and Implemented Research

At Washington State Department of Transportation (WSDOT), utility coordination begins at the 30% design phase by accumulating a list of impacted utilities and reviewing how relocations may fit within the project footprint. WSDOT participates in utility coordinating councils in each county and uses that opportunity to communicate WSDOT and utility owner infrastructure building and/or maintenance plans. WSDOT does not currently use a utility coordinator on each project but is considering it. It recently put in place a list of accommodations to track and indicate utility impacts on projects. WSDOT has recently applied for SHRP 2 Implementation funding for the product bundle of R01A, R01B, and R15B. WSDOT was awarded $150,000 for SHRP 2 R01A and $100,000 for SHRP 2 R15B. Additionally, it just started an online utility permitting database to help identify utilities within a GIS system. Once populated, the system will provide contact information for known utilities. Currently under consideration is the transition of legacy data into the new system.

- Consultant-Led Utility Coordination

WSDOT used consultant-led utility coordination for one major project within an urban area and with several significant complexities.

- Availability of Utility Education and Training

WSDOT does not have utility coordination training available and this is a point of concern.

- Knowledge Gaps Associated with Utility Coordination

WSDOT personnel felt it was important to note that there is not enough understanding of business processes between STAs and utilities. For instance, the importance of communicating budgets and schedules cannot be overestimated. STA personnel should understand that utility resources are not unlimited and, in some cases, STA schedules may not be fiscally possible for the utility. It also is important for communication of project schedules and budgets to occur with the proper personnel within the utility owners (personnel understanding the maintenance, programming, and fiscal constraints of the owner). WSDOT is working toward improvements by increasing consistency in the utility coordination process and early initialization of the utility design phase as part of the transportation project.

CHAPTER FIVE

CONCLUSIONS

This chapter summarizes the findings of this project and draws conclusions on effective utility coordination practices that are in place at state transportation agencies (STAs). The objective of the synthesis was to document how previous research has been incorporated into current utility coordination practice; how STAs and utility stakeholders are scoping, conducting, and managing effective utility coordination; and if there are resources to train and educate on effective utility coordination practices. The synthesis research methodology used surveys of STAs to establish a state of the practice regarding utility coordination and uncovered effective utility coordination practices. Additionally, STAs were surveyed to find what research is being applied and the perceived benefits of said research. The survey was sent to the AASHTO Subcommittee on Right-of-Way, Utilities, and Outdoor Advertising Control. Individualized follow-up bolstered the response rate to 84% (42 states). In addition to the STA survey, a non-STA utilities stakeholder survey was developed and sent to several organizations including the National Utility Locating Contractors Association, the American Society of Civil Engineers Utility Engineering and Surveying Institute (ASCE-UESI), members of the Transportation Research Board Standing Committee on Utilities, and others. There were 29 total responses, 16 of which were utility owners.

Concurrent with the final stages of the survey questionnaires, other STAs were identified both during the literature review and by initial survey responses for follow-up interviews. Six additional states were interviewed and, contrary to the phone/web-based methods indicated in the study work plan, the research team conducted face-to-face interviews while attending the annual meeting of the AASHTO Subcommittee on Right-of-Way, Utilities, and Outdoor Advertising Control. The selection of the interviewees was based on sampling those who applied utility coordination research and current practices in an effective manner. The sample was also influenced by achieving a thorough cross section of the U.S. STAs. The states selected were Kentucky, Maryland, Utah, Virginia, Washington State, and Wyoming. The case example interviews were conducted in person and the discussions were very rich in detail.

KEY FINDINGS

This work produced several key findings:

A Framework or Guidance for Effective Utility Coordination and Applied Research

- There is a substantial lack of structure and guidance in the field of utility coordination, especially regarding the advancements in research; that is, the Strategic Highway Research Program 2 (SHRP 2) products. This relates to state and federal regulation inconsistencies, varying practices within states, and the state-to-state difference in the organization that holds the responsibility for utility. SHRP 2 provides a source of excitement for advancing and improving utility location technologies and coordination, but there is a lack of standard guidance on how to incorporate these products into a sound utility coordination program.

Utility Coordination as Part of the Design Process

- Several decades ago, environmental compliance and transportation project development were disjointed processes. The result was misaligned objectives, which led to delayed project delivery. The National Environmental Policy Act provided a rigid process that tied the environmental compliance and transportation delivery processes together. A similar process or mindset may be necessary for utility coordination. The utility coordination process has been relatively stagnant for decades, while the technology involved in utility facilities has been on a steep curve of advancement. Couple this with competition and the confined resources of utility owners and STAs alike, and the expectation of utility delays on transportation projects will be a dire consequence. Better incorporation of the utility coordination process into the transportation design process is necessary, with early involvement being most critical.

Consultant-Led Utility Coordination

- Consultant-led utility coordination is often used out of necessity (due to lack of personnel availability or experience), but to be effective it must be used with careful controls in place. Consultants certified/prequalified or at least trained in the utility coordination practices applicable to the specific STA may be of benefit to this approach. An evaluation system may also benefit STAs and they can likely expect consultants to involve them in any nonstandard issues that arise. In addition, legality issues could result from consultants not having the statutory authority in some cases to make utility coordination decisions. Issues can arise if the consultants who are performing the coordination duties have any business relationships with the utilities they are relocating.

Effective Utility Coordination Practices

- The top practices determined from the survey are seen in Figure 32. For STAs looking to improve the utility coordination processes, this figure may be a starting point to assess the practices they are currently using. Table 8 presents the same information but with cross analysis of non-STA survey responses and utility owners.

TABLE 8
STA EFFECTIVE UTILITY COORDINATION PRACTICES

Element	Percent of STA Respondents Selected (n = 42)	Number of Non-STA Respondents Selected (n = 29)	Number of Utility Owners Selected (n = 16)
Early Utility Involvement in Design (30% or earlier)	88 ✦	26 ✦	15 ✦
Utility Preconstruction Meetings	67 ☆	20 ✦	12 ✦
Defined Procedures (i.e., Utility Coordination Guidance Manual)	67 ✦	17 ✦	8 ☆
Consideration of Utilities Relocation Schedules in Relation to Project Schedules	74 ✦	15 ☆	10 ✦
Use of SUE (Subsurface Utility Engineering)	57 ☆	13 ☆	2
Regularly Scheduled Meetings with Utility Owners	57 ☆	12 ☆	5
Communication of Short-Range Transportation Plan	21	12 ☆	9 ☆
Use of Utility Corridors	14	12 ☆	8 ☆
Use of Standardized Utility Agreements	60 ☆	8	6
Identify and Plan for Long-Lead Items	50 ☆	8	0
Utility Mapping System (utility location information entered into a GIS-based system)	26	10	7 ☆
Communication of Long-Range Transportation Plan	24	10	7 ☆

✦ = Top three elements selected by respondents. ☆ = Top eight elements selected by respondents.
Respondents were limited to choosing their top eight.

Utility Owner and STA Perceptions

- Beyond showing what practices are considered effective, Table 8 also illustrates potential areas to be addressed concerning the perception of STAs and utility owners. Table 8 shows that early utility involvement in design is the preferred practice and there are also similar feelings for utility preconstruction meetings, consideration of utility and project schedules, and defined procedures. Of note, a substantial disagreement exists about the effectiveness of Subsurface Utility Engineering between the STAs and utility owners. It additionally appears utility owners would prefer to see more use of utility corridors and the sharing of long-range transportation plans.

Legislation, Regulations, and Guidance

- The flexibility in federal legislation, regulations, and guidance, while beneficial to STAs adopting policies to meet their specific needs, creates inconsistencies in utility coordination for utility companies working in multiple states. With many utility facilities moving toward national conglomerates, revisiting this practice may need consideration.

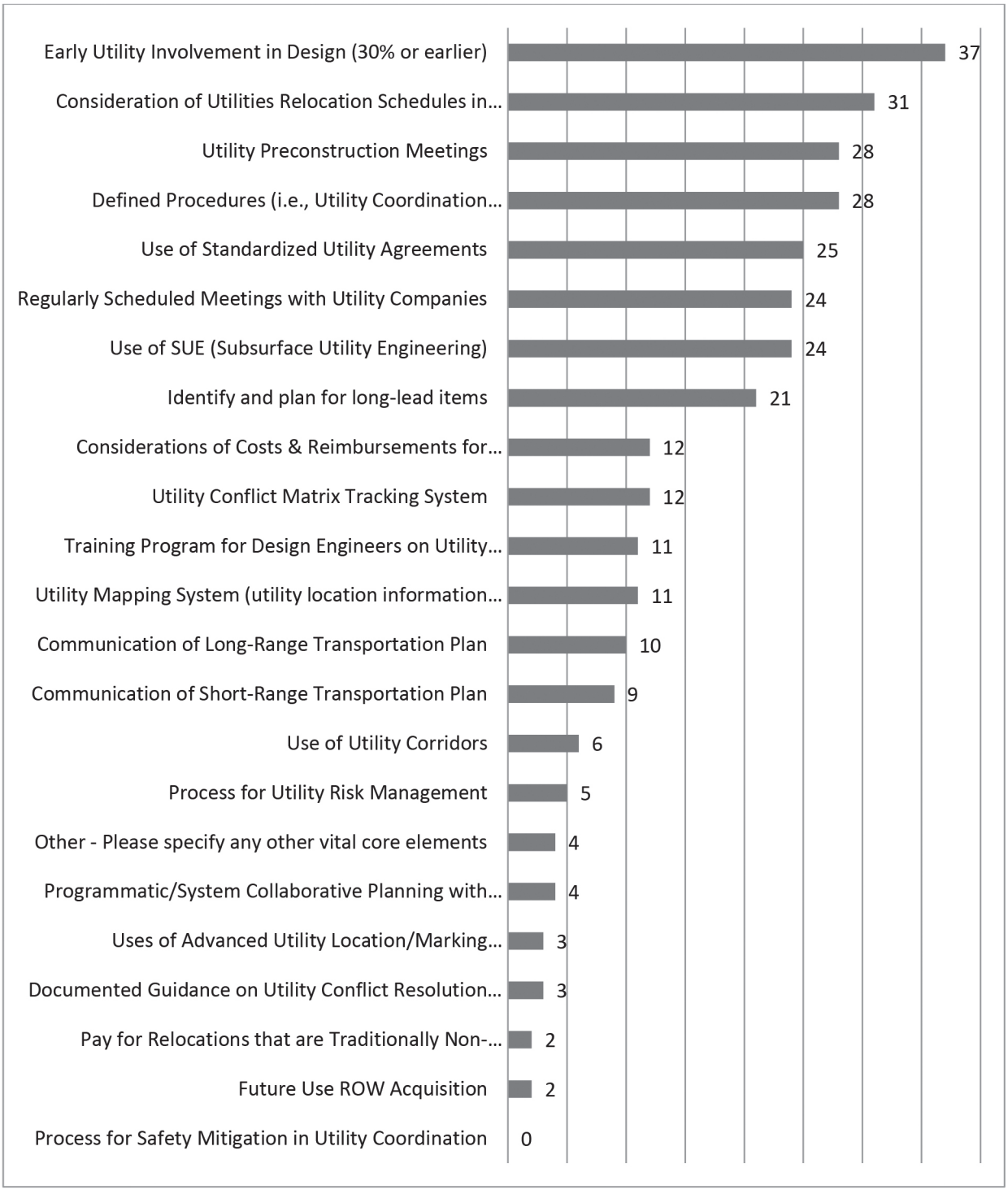

FIGURE 32 STA effective utility coordination practices (limited to choosing top eight).

Training and Education

- The lack of education and training for utility personnel and coordination is significant. As knowledge loss owing to turnover escalates both at STAs and with utility owners, the knowledge gap will grow, and improper utility coordination practices will lead to increased project risks. The National Highway Institute and ASCE-UESI have attempted to fill this void. However, because accommodation policies and legislation vary from state to state, STA-specific training should be considered for clientele outside the STA.

RESEARCH NEEDS

In addition to understanding the use of subsurface utility engineering and advanced utility location technologies, the survey and interview responses indicated that a need exists for standards of practice, guidance, and training for utility coordination. STAs, consultants, and utility owners may benefit from a knowledge management approach such as a guidebook and related training programs for effective utility coordination (Figure 33).

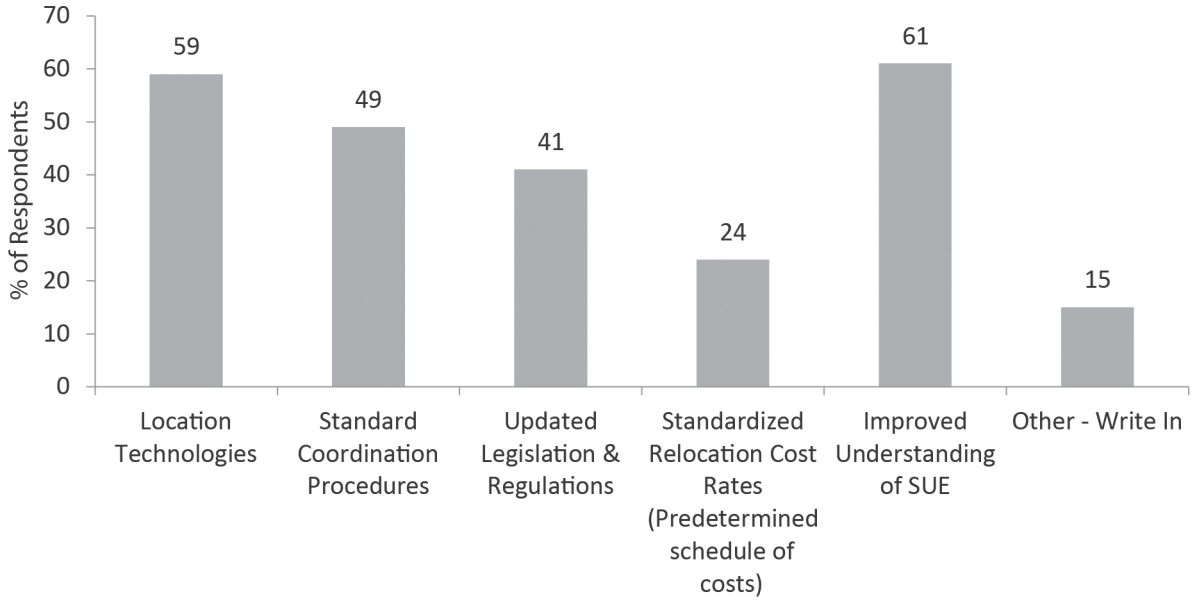

FIGURE 33 STA-indicated areas of need for utility coordination research.

GLOSSARY

Damage Prevention Councils/Utility Coordination Councils—State, regional, or local councils of contractors, utility owners, and other stakeholders who meet regularly to share information, discuss utility damage prevention issues, host large project forums, and promote the use of one-call centers with the goal of promoting safety and protecting utility infrastructure.

One-Call Centers—Typically overseen by a state board and may operate in various fashions. Their main objective is to track potential disturbances to underground utilities (construction and maintenance) as a free service to those making impacts and with fees paid by utility owners who are members of the center.

Subsurface Utility Engineering (SUE)—An engineering practice combining civil engineering, surveying, and geophysics to assess and locate utilities with project limits according to quality levels that can also be thought of as risk levels. Project designers/owners can assign quality levels A (highest level) through D (lowest level) according to the risks associated with a particular utility and potential impact. The quality levels determine the amount and accuracy desirable for a particular underground utility.

Utility Company/Utility Owner—The public or private entity in ownership of a utility. Utility owner and utility company are often used interchangeably but because some municipalities control ownership of utilities, it is more appropriate to use the term "utility owner" for these entities.

Utility Conflict Matrix/Management (UCM)—Frameworks to collect and store potential utility impacts of a transportation project as well as track resolutions and assist in identifying optimal solutions.

Utility Coordination—The active effort to communicate, share information, and interact productively with all applicable stakeholders regarding the utility involvement, adjustment, and relocation during all phases (planning, design, construction, operation, and maintenance) of the delivery of a transportation project (Thorne et al. 1993).

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APPENDIX A

Survey Questionnaire

November 2015

Synthesis 47-14 seeks to determine how previous research has been incorporated into current practice and compile information about how state transportation agencies (STAs) and utility stakeholders are scoping, conducting, and managing effective utility coordination. Additional information will be collected on factors including:

- Identification of the core elements of effective utility coordination;
- Current practices to manage consultant-led utility coordination, both stand-alone and those incorporated into design contracts;
- Current practices to perform utility coordination in-house;
- How and when stakeholders are integrated into the utility coordination process (e.g., design team, contractors, utility owners, consultants, resource agencies);
- Prequalification requirements for consultants and evaluation measures of performance;
- Training and certification available and/or required for utility stakeholders;
- How academic programs are educating students about utility engineering;
- The process by which an effective utility coordination project is scoped (e.g. project schedule, type and complexity of project, level of effort, level of risk);
- Gaps in knowledge and research; and
- Examples of inconsistencies between legislation, regulations, guidance, and practice.

Pilot tests indicated an average time of [X] minutes to complete the survey.

Please complete the online questionnaire by [date]. If you have questions or would prefer to complete a paper-copy questionnaire, please contact:

Roy Sturgill Email: roy.sturgill@uky.edu Phone: (859) 218-0119

Please include your contact information. NCHRP will email you a link to the online report when it is completed.

Agency: _____

Address:_____

_____

City:_____

State: _____

ZIP: _____

Questionnaire Contact: _____

Position/Title: _____

In case of questions and for NCHRP to send you a link to the final report, please provide:

Tel:_____

Email: _____

General Utility Coordination Process Information

1. Does your agency use documented procedures (manual of instructions, policy, and/or guidance manual) for utility coordination? (There is a follow-up opportunity to provide documentation, web link(s), file(s), or contact information at the conclusion of this survey.)

   ☐ Yes

   ☐ No

2. Would you be willing to participate in a follow-up phone interview?

   ☐ Yes

   ☐ No

3. Please rank the statements below that **best** describes your STA's **typical approach** to the utility coordination process? (1 being the most applicable term, 3 being the least applicable term)

   – Proactive (try to anticipate needs and accomplish them prior to realization)

   – Reactive (wait until needs are realized and then start to address them)

   – Interactive (work collaboratively with project teams in the creation and addressing of needs)

   Comments: Click here to enter text.

4. Please rate the effectiveness of your utility relocation process in **EACH** of the following areas (**RATE** each of the areas according to the following scale: 5-"Not Effective," 4-"Somewhat Effective," 3-"Effective," 2-"Very Effective," 1-"Extremely Effective").

   – Timely Utility Involvement on the Project

   – Utility Coordination Communication

   – Utility Relocation/Alignment Is Considered Within Design Decisions

   – Minimized Utility Relocation Costs

   – Timely Utility Relocations

5. Please provide a short statement of support for your ratings in Question 4. For example, an STA may respond that they have Effective Utility Coordination practices on the basis that utility relocations are rarely impactful of lettings or project construction and they are involved early and work collaboratively as part of the project development team.

   Click here to enter text.

6. Has your agency performed any analysis of the effectiveness (in terms of the amount of utility delays during construction, percent of relocations complete prior to letting, or letting delays due to utilities) of your procedures for utility coordination? (There is a follow-up opportunity to provide documentation, web link(s), file(s), or contact information at the conclusion of this survey.)

   ☐ Yes

   ☐ No

   ☐ Unsure

7. In your STA, what best describes the location of the business unit responsible for utility coordination?

   ☐ Division of Design

   ☐ Division of Right-of-Way

   ☐ Division of Permitting

   ☐ Division of Maintenance/Operations

- ☐ Division of Utilities
- ☐ Other: Click here to enter text.

8. Stemming from Question 7, is the utility coordination business unit organized differently at the regional/district level versus the central/statewide level?

- ☐ Yes
- ☐ No

9. To expound upon your response in Questions 7 and 8, please provide a short statement regarding utility coordination within the agency. We would like to know who is responsible for utility coordination at a project level (one utility coordinator, project managers, a team of utility coordinators, or consultants), and if utility coordination responsibilities change within the project; for instance, some states handle utility coordination with a centralized utility coordinator within design but it becomes the district construction manager's responsibility during construction.

Click here to enter text.

10. What **core** elements would you consider the most vital for an effective utility coordination process? (Please select up to your top **8 choices**.)

- ☐ Defined Procedures (i.e., Utility Coordination Guidance Manual)
- ☐ Early Utility Involvement in Design (30% or earlier)
- ☐ Utility Mapping System (utility location information entered into a GIS-based system)
- ☐ Use of Utility Corridors
- ☐ Future Use ROW Acquisition
- ☐ Use of SUE (Subsurface Utility Engineering)
- ☐ Use of Standardized Utility Agreements
- ☐ Pay for Relocations That Are Traditionally Non-reimbursable
- ☐ Identify and Plan for Long-Lead Items
- ☐ Communication of Long-Range Transportation Plan
- ☐ Communication of Short-Range Transportation Plan
- ☐ Regularly Scheduled Meetings with Utility Owners
- ☐ Training Program for Design Engineers on Utility Coordination
- ☐ Utility Conflict Matrix Tracking System
- ☐ Documented Guidance on Utility Conflict Resolution Methods (by type of conflict)
- ☐ Utility Preconstruction Meetings
- ☐ Programmatic/System Collaborative Planning with Utilities (matching utility infrastructure plans to long-term highway plans)
- ☐ Process for Utility Risk Management
- ☐ Considerations of Costs & Reimbursements for Design/Construction Versus Utility Relocations
- ☐ Consideration of Utilities Relocation Schedules in Relation to Project Schedules
- ☐ Uses of Advanced Utility Location/Marking Technologies (Marker Balls, etc.)
- ☐ Process for Safety Mitigation in Utility Coordination
- ☐ Other: Click here to enter text.

11. At what point in project development/design does the utility coordination process typically begin? (Select the best answer relative to your STA.)

- ☐ During Planning
- ☐ 10% Project Design Complete
- ☐ 30% Project Design Complete
- ☐ 60% Project Design Complete
- ☐ 90% Project Design Complete

Comments: Click here to enter text.

12. When do particular project stakeholders become involved in your utility coordination process (as a percent of the utility coordination and relocation process—the process being considered is from identified potential conflicts through the relocation of affected utilities)?

Project Design Managers	☐Start	☐10%	☐30%	☐60%	☐90%
Project Design Consultants	☐Start	☐10%	☐30%	☐60%	☐90%
Location Services	☐Start	☐10%	☐30%	☐60%	☐90%
ROW Agents/Managers	☐Start	☐10%	☐30%	☐60%	☐90%
Utility Owners	☐Start	☐10%	☐30%	☐60%	☐90%
Utility Contractors	☐Start	☐10%	☐30%	☐60%	☐90%
Utility Designers	☐Start	☐10%	☐30%	☐60%	☐90%
Other: Click here to enter text.	☐Start	☐10%	☐30%	☐60%	☐90%

13. What has been your STA's level of implementation of the following SHRP2 Utility Focused practices?

SHRP2 R01A: 3D Utility Location Data Repository ~ technologies that support, store, retrieve, and use 3D utility location data

- ☐ None
- ☐ Little
- ☐ Some
- ☐ Complete
- ☐ Not Sure

SHRP2 R01B: 3D Utility Investigation Technologies ~ the advanced application of SUE through combining multiple technologies (multi-channel ground penetrating radar, time domain electromagnetic induction, etc.) based on soil type, utility material, terrain type, and other features

- ☐ None
- ☐ Little
- ☐ Some
- ☐ Complete
- ☐ Not Sure

SHRP2 R15B: Identifying and Managing Utility Conflicts ~ the development and use of a utility conflict matrix and database system to manage utility conflicts throughout the design and construction

☐ None

☐ Little

☐ Some

☐ Complete

☐ Not Sure

Comments (please add comments, especially if you incorporated these practices prior to the SHRP2 projects, or if you are a pilot state for any of the above): Click here to enter text.

14. Is a single point of contact used to conduct and manage the utility coordination process (i.e., you attempt to have a single project utility coordinator for the life of the project)?

☐ Yes

☐ No

15. In regard to Question 14, **please expound** as to how the utility coordination is managed.

Click here to enter text.

16. Does your STA have a process for setting the scope (utility relocation/coordination, project schedule/durations, and cost estimate) required for a project's utility coordination? (There is a follow-up opportunity to provide documentation, web link(s), file(s), or contact information at the conclusion of this survey.)

☐ Yes

☐ No

17. Please rank order the factors considered in scoping an individual project's utility coordination. (1 being the top consideration and 9 being the least important)

– Project Schedule

– Number of Utilities Involved

– Type of Utilities Involved

– Number of ROW Parcels Involved

– ROW Parcels Type (Residential, Commercial, Urban, Rural, etc.)

– Project Classification (New Route, Road Widening, Resurfacing, etc.)

– Location Classification (Urban versus Rural)

– Level of Coordination Effort

– Level of Utility Risk

18. What utility coordination practices are used by your STA? (**Please check all that apply;** include practices that you use in a limited fashion or even as a trial. Many of these are not appropriate for use on every project.)

☐ Defined Procedures (i.e., Utility Coordination Guidance Manual)

☐ Early Utility Involvement in Design (30% or earlier)

☐ Utility Mapping System (utility location information entered into a GIS-based system)

☐ Use of Utility Corridors

☐ Future Use ROW Acquisition

☐ Use of SUE (Subsurface Utility Engineering)

- ☐ Use of Standardized Utility Agreements
- ☐ Pay for Relocations That Are Traditionally Non-reimbursable
- ☐ Identify and Plan for Long-Lead Items
- ☐ Communication of Long-Range Transportation Plan
- ☐ Communication of Short-Range Transportation Plan
- ☐ Regularly Scheduled Meetings with Utility Owners
- ☐ Training Program for Design Engineers on Utility Coordination
- ☐ Utility Conflict Matrix Tracking System
- ☐ Documented Guidance on Utility Conflict Resolution Methods (by type of conflict)
- ☐ Utility Preconstruction Meetings
- ☐ Programmatic/System Collaborative Planning with Utilities (matching utility infrastructure plans to long-term highway plans)
- ☐ Process for Utility Risk Management
- ☐ Considerations of Costs & Reimbursements for Design/Construction Versus Utility Relocations
- ☐ Consideration of Utilities Relocation Schedules in Relation to Project Schedules
- ☐ Uses of Advanced Utility Location/Marking Technologies (Marker Balls, etc.)
- ☐ Process for Safety Mitigation in Utility Coordination
- ☐ Other: Click here to enter text.
- ☐ Other: Click here to enter text.

19. Rate utility coordination involved with alternative contract procurement methods (design-build, P3, CMGC) in comparison to utility coordination on design-bid-build projects.

- ☐ Better
- ☐ Same
- ☐ Worse
- ☐ Not Applicable

20. In regard to Question 19, **please expound** as to how the utility coordination is affected by alternative procurement methods.

Click here to enter text.

Practices Related to Consultant-Led Utility Coordination

21. Does your STA use consultant-led utility coordination (either as part of a stand-alone utility consultant agreement or a project design consultant agreement? (If no, skip to the next section of questions.)

- ☐ Yes
- ☐ No

22. Please categorize your contracts associated with consultant-led coordination.

- ☐ Stand-alone
- ☐ Part of a Project Design Consultant Agreement
- ☐ Both

23. If you use a stand-alone utility consultant agreement, how would you rate consultant-led utility coordination relative to in-house?

- ☐ Better
- ☐ Same
- ☐ Worse
- ☐ Not Applicable

Comments: Click here to enter text.

24. If the utility coordination is part of a project design consultant agreement, how would you rate consultant-led utility coordination relative to in-house?

- ☐ Better
- ☐ Same
- ☐ Worse
- ☐ Not Applicable

Comments: Click here to enter text.

25. Does your agency require pre-qualifications (including qualification as part of the consultant solicitation) for consultant-led utility coordination? (There is a follow-up opportunity to provide documentation, web link(s), file(s), or contact information at the conclusion of this survey.)

- ☐ Yes
- ☐ No

26. Does your agency evaluate performance in consultant-led utility coordination? (There is a follow-up opportunity to provide documentation, web link(s), file(s), or contact information at the conclusion of this survey.)

- ☐ Yes
- ☐ No

27. How does the STA manage the consultant-led utility coordination? (Select the best answer relative to your STA.)

- ☐ Central/Statewide Oversight
- ☐ Local Coordinator Oversight
- ☐ Local Design Team Oversight
- ☐ Other: Click here to enter text.

28. Why does your STA use consultant-led utility coordination? (Select the best answer relative to your STA.)

- ☐ Limited Number of STA In-House Staff
- ☐ Lack of STA In-House Expertise
- ☐ Complexity of Design
- ☐ Complexity of Utilities Involved
- ☐ Scope/Size of Project
- ☐ Other: Click here to enter text.

Utility Coordination Certification, Training, and Education Questions

29. Does your STA make available and/or require any certification or training for utility coordination? (If no, skip to the next section of questions.) (There is a follow-up opportunity to provide documentation, web link(s), file(s), or contact information at the conclusion of this survey.)

☐ Yes

☐ No

Comments: Click here to enter text.

30. What stakeholder groups are offered training in utility coordination by your STA? (Select all that apply.)

☐ In-House Utility Coordination Staff

☐ In-House Design Staff

☐ In-House Construction Staff

☐ Stand-Alone Utility Coordination Consultants

☐ Design Consultants Conducting Utility Coordination

☐ Other: Click here to enter text.

☐ Other: Click here to enter text.

31. Do any universities/trade programs/technical colleges offer utility coordination curriculum within your state?

☐ Yes

☐ No

☐ Unsure

Utility-Related Legislation, Regulations, and Guidance Questions

32. Do you find there are inconsistencies in state or federal legislation or regulations causing utility coordination issues? (If no or unsure, skip the next question.)

☐ Yes

☐ No

☐ Unsure

33. If the response to Question 32 is yes, please give a brief description below so we can further research the inconsistencies.

Click here to enter text.

34. Do you find there are guidance (STA guidance manuals, federal guidance, etc.) related inconsistencies causing utility coordination issues? (If no, skip the next question.)

☐ Yes

☐ No

35. If the response to Question 34 is yes, please give a brief description below so we can further research the inconsistencies.

Click here to enter text.

Future Opportunities

36. Which areas seem to be of most need relative to the future of the utility engineering field? (Select your **top 3**.)

- ☐ Location Technologies
- ☐ Standard Coordination Procedures
- ☐ Updated Legislation & Regulations
- ☐ Standardized Relocation Cost Rates (Predetermined Schedule of Costs)
- ☐ Improved Understanding of SUE
- ☐ Other: Click here to enter text.
- ☐ Other: Click here to enter text.

37. What knowledge gaps (areas for future technology, current legislation needs, etc.) do you see in the field of utility coordination?

Click here to enter text.

Follow-Up Documentation

38. Question 1 asked, "Does your agency use documented procedures (manual of instructions, policy, and/or guidance manual) for utility coordination?" If you responded yes, please attach any documentation (or relevant tools) in the form of text, web link(s), file(s), or contact information to make a request for the information below.

Click here to enter text.

39. Question 6 asked, "Has your agency performed any analysis of the effectiveness (in terms of the amount of utility delays during construction, percent of relocations complete prior to letting, or letting delays due to utilities) of your procedures for utility coordination?" If you responded yes, please attach any associated documentation of the analysis in the form of text, web link(s), file(s), or contact information to make a request for the information below.

Click here to enter text.

40. Question 16 asked, "Does your STA have a process for setting the scope (utility relocation/coordination, project schedule/durations, and cost estimate) required for a project's utility coordination?" If you responded yes, please attach any documentation in the form of text, web link(s), file(s), or contact information to make a request for the information below.

Click here to enter text.

41. Question 25 asked, "Does your agency require pre-qualifications (including qualification as part of the consultant solicitation) for consultant-led utility coordination?" If you responded yes, please attach any documentation below on the types of pre-qualifications required in the form of text, web link(s), file(s), or contact information to make a request for the information.

Click here to enter text.

42. Question 26 asked, "Does your agency evaluate performance in consultant-led utility coordination?" If you responded yes, please attach any documentation in the form of text, web link(s), file(s), or contact information to make a request for the information below.

Click here to enter text.

43. Question 29 asked, "Does your STA make available and/or require any certification or training for utility coordination?" If you responded yes, please attach any documentation in the form of text, web link(s), file(s), or contact information to make a request for the information below.

    Click here to enter text.

The survey is complete. Thank you for your participation!

NCHRP Topic 47-14 Non-State Stakeholder Survey Questionnaire

November 2015

Synthesis 47-14 seeks to determine how previous research has been incorporated into current practice and compile information about how state transportation agencies (STAs) and utility stakeholders are scoping, conducting, and managing effective utility coordination. Additional information will be collected on factors including:

- Identification of the core elements of effective utility coordination;
- Current practices to manage consultant-led utility coordination, both stand-alone and those incorporated into design contracts;
- Current practices to perform utility coordination in-house;
- How and when stakeholders are integrated into the utility coordination process (e.g., design team, contractors, utility owners, consultants, resource agencies);
- Pre-qualification requirements for consultants and evaluation measures of performance;
- Training and certification available and/or required for utility stakeholders;
- How academic programs are educating students about utility engineering;
- The process by which an effective utility coordination project is scoped (e.g., project schedule, type and complexity of project, level of effort, level of risk);
- Gaps in knowledge and research; and
- Examples of inconsistencies between legislation, regulations, guidance, and practice.

Pilot tests indicated an average time of [X] minutes to complete the survey.

Please complete the online questionnaire by [date]. If you have questions or would prefer to complete a paper-copy questionnaire, please contact:

Roy Sturgill Email: roy.sturgill@uky.edu Phone: (859) 218-0119

Please include your contact information. NCHRP will email you a link to the online report when it is completed.

Company/Agency:_____

Address:_____

_____

City:_____

State: _____

ZIP: _____

Questionnaire Contact: _____

Position/Title: _____

In case of questions and for NCHRP to send you a link to the final report, please provide:

Tel:_____

Email: _____

General Utility Coordination Process Information

1. Which of the following best describes your agency?

- ☐ Utility Coordination Consultant
- ☐ Road Design Consultant Conducting Utility Coordination
- ☐ Utility Owner (Design/Construction/Management)
- ☐ Utility Designer (Consultant to Utility Company)
- ☐ Utility Contractor (Consultant to Utility Company)
- ☐ Researcher
- ☐ Other: Click here to enter text.

2. If your agency/company manages the utility coordination for an STA, do you use documented procedures (policy and/or guidance manual)? (There is a follow-up opportunity to provide documentation, web link(s), file(s), or contact information at the conclusion of this survey.)

- ☐ Yes
- ☐ No
- ☐ Not Applicable

3. Would you be willing to participate in a follow-up phone interview?

- ☐ Yes
- ☐ No

4. Does your company have an interest in improved utility coordination regarding an STA's schedule and budget (i.e., our company strives to aid in STA project success)?

- ☐ Yes
- ☐ No
- ☐ Unsure

Please provide comments regarding your response: Click here to enter text.

5. What **core** elements would you consider the most vital for an effective utility coordination process? (Please select your **top 8 choices**.)

- ☐ Defined Procedures (i.e., Utility Coordination Guidance Manual)
- ☐ Early Utility Involvement in Design (30% or earlier)
- ☐ Utility Mapping System (utility location information entered into a GIS-based system)
- ☐ Use of Utility Corridors
- ☐ Future Use ROW Acquisition
- ☐ Use of SUE (Subsurface Utility Engineering)
- ☐ Use of Standardized Utility Agreements
- ☐ Pay for Relocations That Are Traditionally Non-reimbursable
- ☐ Identify and Plan for Long-Lead Items
- ☐ Communication of Long-Range Transportation Plan
- ☐ Communication of Short-Range Transportation Plan
- ☐ Regularly Scheduled Meetings with Utility Owners

- ☐ Training Program for Design Engineers on Utility Coordination
- ☐ Utility Conflict Matrix Tracking System
- ☐ Documented Guidance on Utility Conflict Resolution Methods (by type of conflict)
- ☐ Utility Preconstruction Meetings
- ☐ Programmatic/System Collaborative Planning with Utilities (matching utility infrastructure plans to long-term highway plans)
- ☐ Process for Utility Risk Management
- ☐ Considerations of Costs & Reimbursements for Design/Construction Versus Utility Relocations
- ☐ Consideration of Utilities Relocation Schedules in Relation to Project Schedules
- ☐ Uses of Advanced Utility Location/Marking Technologies (Marker Balls, etc.)
- ☐ Process for Safety Mitigation in Utility Coordination
- ☐ Other: Click here to enter text.

6. At what point in project development does your company's typically get involved regarding utility coordination? (Select the answer based upon your agency/company experience.)

- ☐ During Planning
- ☐ 10% Project Design Complete
- ☐ 30% Project Design Complete
- ☐ 60% Project Design Complete
- ☐ 90% Project Design Complete

Comments: Click here to enter text.

7. Is a single point of contact used to conduct and manage the utility coordination process (i.e., you attempt to have a single project utility coordinator for the life of the project)?

- ☐ Yes
- ☐ No
- ☐ Not Applicable

8. In regard to Question 7, **please expound** as to how the utility coordination is managed.

Click here to enter text.

9. Which of the following practices have you witnessed being used within utility coordination? (Please check all that apply.)

- ☐ Defined Procedures (i.e., Utility Coordination Guidance Manual)
- ☐ Early Utility Involvement in Design (30% or earlier)
- ☐ Utility Mapping System (utility location information entered into a GIS-based system)
- ☐ Use of Utility Corridors
- ☐ Future Use ROW Acquisition
- ☐ Use of SUE (Subsurface Utility Engineering)
- ☐ Use of Standardized Utility Agreements
- ☐ Pay for Relocations That Are Traditionally Non-reimbursable
- ☐ Identify and Plan for Long-Lead Items
- ☐ Communication of Long-Range Transportation Plan

- ☐ Communication of Short-Range Transportation Plan
- ☐ Regularly Scheduled Meetings with Utility Owners
- ☐ Training Program for Design Engineers on Utility Coordination
- ☐ Utility Conflict Matrix Tracking System
- ☐ Documented Guidance on Utility Conflict Resolution Methods (by type of conflict)
- ☐ Utility Preconstruction Meetings
- ☐ Programmatic/System Collaborative Planning with Utilities (matching utility infrastructure plans to long-term highway plans)
- ☐ Process for Utility Risk Management
- ☐ Considerations of Costs & Reimbursements for Design/Construction Versus Utility Relocations
- ☐ Consideration of Utilities Relocation Schedules in Relation to Project Schedules
- ☐ Uses of Advanced Utility Location/Marking Technologies (Marker Balls, etc.)
- ☐ Process for Safety Mitigation in Utility Coordination
- ☐ Other: Click here to enter text.
- ☐ Other: Click here to enter text.

10. Rate utility coordination involved with alternative contract procurement methods (design-build, P3, CMGC) in comparison to utility coordination on design-bid-build projects.

- ☐ Better
- ☐ Same
- ☐ Worse
- ☐ Not Applicable

11. In regard to Question 10, **please expound** as to how the utility coordination is affected by alternative procurement methods.

Click here to enter text.

Practices Related to Consultant-Led Utility Coordination

12. How would you rate consultant-led utility when compared to coordination by STA staff?

- ☐ Better
- ☐ Same
- ☐ Worse
- ☐ Not Applicable

13. Please categorize the types of contracts your organization has used or been involved in associated with consultant-led coordination.

- ☐ Stand-Alone
- ☐ Incorporated into Project Design
- ☐ Both
- ☐ None

14. Does your agency/organization require or been required to attain pre-qualifications for consultant-led utility coordination?

- ☐ Yes
- ☐ No
- ☐ N/A

15. Has your agency/organization evaluated, or been evaluated on, performance in consultant-led utility coordination?

- ☐ Yes
- ☐ No
- ☐ N/A

16. Would you like to note any challenges relative to consultant-led utility coordination?

Click here to enter text.

17. Would you like to note any opportunities relative to consultant-led utility coordination?

Click here to enter text.

Utility Coordination Certification, Training, and Education Questions

18. Does your agency/company make available or been required to have any certification or training for utility stakeholders? (If no, skip to the next section of questions.)

- ☐ Yes
- ☐ No

19. If the response to Question 18 is yes, please discuss below.

Click here to enter text.

20. Do any universities/trade programs/technical colleges offer utility coordination curriculum within your state?

- ☐ Yes
- ☐ No
- ☐ Unsure

Utility-Related Legislation, Regulations, and Guidance Questions

21. Do you find there are inconsistencies in state or federal legislation or regulations causing utility coordination issues? (If no, skip the next question.)

- ☐ Yes
- ☐ No

22. If the response to Question 21 is yes, please give a brief description below so we can further research the inconsistencies.

Click here to enter text.

23. Do you find there are guidance (STA guidance manuals, federal guidance, etc.) related inconsistencies causing utility coordination issues? (If no, skip the next question.)

- ☐ Yes
- ☐ No

24. If the response to Question 23 is yes, please give a brief description below so we can further research the inconsistencies.

Click here to enter text.

Future Opportunities

25. Which areas seem to be of most need relative to the future of the utility engineering field? (Select your **top 3**.)

- ☐ Location Technologies
- ☐ Standard Coordination Procedures
- ☐ Updated Legislation & Regulations
- ☐ Standardized Relocation Cost Rates (Predetermined Schedule of Costs)
- ☐ Improved Understanding of SUE
- ☐ Other: Click here to enter text.
- ☐ Other: Click here to enter text.

26. What knowledge gaps (areas for future technology, current legislation needs, etc.) do you see in the field of utility coordination?

Click here to enter text.

Follow-Up Documentation

27. Question 2 asks, "If your agency/company manages the utility coordination for an STA, do you use documented procedures (policy and/or guidance manual)?" If you responded yes, please attach any documentation below on the types of pre-qualifications required in the form of text, web link(s), file(s), or contact information to make a request for the information.

Click here to enter text.

The survey is complete. Thank you for your participation!

APPENDIX B
INTERVIEW TOOL

INTERVIEWEE: _____

DATE: _____

AGENCY:

1. Discuss utility coordination at your DOT.
    a. What methods stand out as contributing to your utility coordination success?
    b. How would you improve your DOT's handling of utility coordination?
    c. Do you measure utility coordination effectiveness qualitatively or quantitatively?
    d. Have you made any recent changes to the way you conduct utility coordination? Any incorporation of recent research?
    e. In what ways do you feel you are effectively applying recent utility coordination research and current practices?
    f. Have you incorporated any new technologies within utility coordination recently? Have those been successful?
    g. How and when should utility coordination be initiated during a project?
2. Do you use consultant-led utility coordination? If so, what leads to that decision? What is your experience with it—benefits, problems, etc.?
3. Do you think proper training and education exists for utility coordination and can you provide an example?
4. Discuss any knowledge gaps and needs relative to utility coordination.
5. Could you briefly describe a project with your DOT with successful utility coordination? How about a project that was problematic?

APPENDIX C

Links to STA Utility Coordination Procedures

State	Document/Webpage Title	Link
WY	Operating Policy 19-7: Utility and Railroad Adjustments	http://surveygizmoresponseuploads.s3.amazonaws.com/fileuploads/64484/2563290/180-5fb0edece4782da40c4d413d6b70602a_OpPolicy_19-7.pdf
	Operating Policy 19-3: Right-of-Way Encroachment	http://surveygizmoresponseuploads.s3.amazonaws.com/fileuploads/64484/2563290/26-5fb0edece4782da40c4d413d6b70602a_OpPolicy_19-3.pdf
	Utility Relocation Assistance	http://surveygizmoresponseuploads.s3.amazonaws.com/fileuploads/64484/2563290/57-5fb0edece4782da40c4d413d6b70602a_2012-Nov+2++Chapter+28.pdf
	Utility Accommodation Regulation	http://surveygizmoresponseuploads.s3.amazonaws.com/fileuploads/64484/2563290/248-5fb0edece4782da40c4d413d6b70602a_WYDOT+Utility+Accommodation+Regulations_Dec+2012.pdf
CA	Utility Relocations	http://www.dot.ca.gov/hq/row/rowman/manual/ch13.pdf
AR	Utility Accommodation Policy	http://arkansashighways.com/right_of_way_division/utility_accomodation.aspx
DE	Transportation Solutions	http://deldot.gov/information/business/drc/manuals/utilities_manual_2008_may_5.pdf
	Design Resource Center - Utilities	http://deldot.gov/information/business/drc/utilities.shtml
	Utility Coordination Guidelines	http://surveygizmoresponseuploads.s3.amazonaws.com/fileuploads/64484/2563290/180-217106fc55c89a604be8c6b3d5c8a805_DelDOT+Utility+Coordination+Guidelines+-+2015.docx
WV	Accommodation of Utilities on Highway Right-of-Way and Adjustment and Relocation of Utility Facilities on Highway Projects	http://www.transportation.wv.gov/highways/engineering/files/ACCOMMODATION_OF_UTILITIES.pdf
GA	The State Office of Utilities	http://www.dot.ga.gov/PS/Utilities
UT	Utilities and Railroads	http://www.udot.utah.gov/main/f?p=100:pg:0::::V,T:,3508
	Manuals of Instruction	http://www.udot.utah.gov/main/f?p=100:pg:0:::1:T,V:3834
PA	Design Manual Part 5 Utility Relocation	http://surveygizmoresponseuploads.s3.amazonaws.com/fileuploads/64484/2563290/26-bcdf872036eb6c98812243d21a8011a1_DM-5.pdf
MO	Utility Procedures	http://epg.modot.mo.gov/index.php?title=Category:643_Utility_Procedures
AL	AL DOT Utilities Manual	http://www.dot.state.al.us/rwweb/doc/proceduralmanuals/ALDOT_Design_utman.pdf
NY	Highway Design Manual Chapter 13: Utilities	https://www.dot.ny.gov/divisions/engineering/design/dqab/hdm/chapter-13
NH	Utility Coordination Process (Documentation)	http://surveygizmoresponseuploads.s3.amazonaws.com/fileuploads/64484/2563290/239-091b8fa712cd018aaf57054a55890412_Process+-+Verification.docx
	Utility Coordination Process (Relocation)	http://surveygizmoresponseuploads.s3.amazonaws.com/fileuploads/64484/2563290/191-9b73f828c17f871d8efc92a2550dd3cb_Process+-+Relocation.docx
	Utility Coordination Process (Pre-Hearing)	http://surveygizmoresponseuploads.s3.amazonaws.com/fileuploads/64484/2563290/239-2a1b42fb358d2c11c00b644550e8eb19_Process+-+Pre-Hearing.docx
	Utility Coordination Process (Final Documents)	http://surveygizmoresponseuploads.s3.amazonaws.com/fileuploads/64484/2563290/107-a466e544ab5b71f49e471046e7156211_Process+-+Final+Documents.docx
	Utility Coordination Process (Construction)	http://surveygizmoresponseuploads.s3.amazonaws.com/fileuploads/64484/2563290/191-56faf9d6ef90097d4a6a97d144c2fe84_Process+-+Construction.docx
AK	Statewide Design & Engineering Services> Publications	http://www.dot.state.ak.us/stwddes/dcspubs/index.shtml#
MN	Utility Accommodation & Coordination Manual	http://surveygizmoresponseuploads.s3.amazonaws.com/fileuploads/64484/2563290/107-4d625e1a379a62f760eb59c289c76f9e_Utility+Manual.pdf
ME	MaineDOT Utility Services	http://www.maine.gov/mdot/utilities/
	Utility Accommodation Rules	http://surveygizmoresponseuploads.s3.amazonaws.com/fileuploads/64484/2563290/47-2e7c08767997e0407aec17ec348eb459_FINAL2014UtilAcmdnRules.pdf
CT	Public Service Facility Policy and Procedures for Highways in Connecticut	http://www.ct.gov/dot/lib/dot/documents/dutilities/UtilityPolicyProcedures.pdf
NC	Utilities Manuals	https://connect.ncdot.gov/municipalities/Utilities/Pages/UtilitiesManuals.aspx
NM	Requirements for Occupancy of State Highway System Right-of-Way by Utility Facilities	http://surveygizmoresponseuploads.s3.amazonaws.com/fileuploads/64484/2563290/107-88df26250860b82a90ff3959ebda09c6_17NMAC++Regs.pdf
MD	Project Utility Coordination Guideline	http://surveygizmoresponseuploads.s3.amazonaws.com/fileuploads/64484/2563290/107-ee0f83db089ce97e657c1e5a9807c1a3_Project+Utility+Coordination+Guideline-3-31-2015.docx
ND	Design Manual Reference and Forms	http://www.dot.nd.gov/manuals/design/designmanual/reference-forms.htm

Abbreviations and acronyms used without definitions in TRB publications:

A4A	Airlines for America
AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
MAP-21	Moving Ahead for Progress in the 21st Century Act (2012)
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TDC	Transit Development Corporation
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation

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